West Eugene Wetlands Mitigation Bank

Annual Report - 2003

August 2004

This report was prepared by the Parks and Open Space Division
of the City of Eugene's Public Works Department

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Chapter 1: Introduction

Background

The West Eugene Wetland Mitigation Bank Program operates under an agreement between the Oregon Department of State Lands, Oregon Department of Environmental Quality, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, and the City of Eugene. The Memorandum of Agreement (MOA) establishing the Bank was signed in 1995.

This is the eighth annual report required as a condition of the MOA that established the West Eugene Wetland Mitigation Bank (Bank). This annual report serves two primary purposes:

1. To fulfill the technical reporting requirements identified in the MOA.
2. To provide a broader view of the Bank's operations and accomplishments for a general audience who view the Bank as a model project in Oregon and the United States.

Organization of this report

This report is organized into two main parts with an introduction:

Chapter 1: Introduction. This chapter provides an overview of the mitigation bank program and this annual report.

Part 1: Financial and Planning Information

Chapter 2: Credit and Financial Summary. This chapter describes the financial status of the Bank. Information on credit sales, credit generation, Bank expenditures, and a financial reconciliation are included.

Chapter 3: Capital Improvement Plan. This chapter presents the Bank's proposed future projects, from 2004 through 2006.

Chapter 4: **Seed Program**. This chapter describes the seed procurement activities of the Bank.

Part 2: Site reports

Chapter 5: Introduction to Site Reports. This chapter contains an overview of the information contained in the site reports. It also presents the structure for the reports.

Chapters 6 - 14: Site reports. These chapters include information on individual mitigation bank sites including: background, design goals, management actions from the previous year, and recommended actions for 2004. The monitoring reports are also included.

Appendices:

A - Monitoring Methods. This section is a description of the data collection methods employed to obtain data used in the monitoring reports.

B - Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

C - Rainfall Graph. This graph shows monthly rainfall totals for the Eugene Airport during 2002-2003 compared to the mean and standard deviation of monthly rainfall between 1940 and 2003.

A brief overview of wetland regulation and planning

Wetlands are regulated by a combination of Federal, State, and local regulations. At the Federal level, wetlands are regulated by U.S. Army Corps of Engineers under the Clean Water Act and the Rivers and Harbors Act, as well as by the U.S. Natural Resources Conservation Service under the federal Farm Bill. At the State level, wetlands are regulated by the Oregon Department of State Lands under the State Removal-Fill Law. At the local level, wetlands are also regulated by the West Eugene Wetlands Plan, Oregon's first Wetland Conservation Plan. The West Eugene Wetlands Plan (Plan) was originally adopted by the Eugene City Council and the Lane County Board of Commissioners in 1992, and then amended in 2000 and 2002. The Plan is a multiple objectives planning document that provides a vision for wetland protection while accommodating development. The Plan policies call for creation of a mitigation bank to help fund restoration and enhancement. The West Eugene Wetlands Mitigation Bank was created to meet this need.

Mitigation bank program

Why a mitigation bank? The advantage of a mitigation bank is that mitigation actions are planned within the context of the wetland system where the most suitable sites are identified, acquired, and restored in advance of wetland impact. This strategy is preferred to the alternative that inevitably results in incremental and disconnected attempts at mitigation.

Why a public mitigation bank? The advantage of a public mitigation bank is that the functions and values that the wetland resource may provide are accessible to the community. Although use may be restricted, it is not prohibited. The public is able to utilize opportunities for recreation and education. The lands of the West Eugene Wetlands Program comprise the largest component of the open space system within the City’s Urban Growth Boundary. Furthermore, the bank is managed by the City, which is held accountable by the community that it represents.

What is the West Eugene Wetland Mitigation Bank? The West Eugene Wetland Mitigation Bank program includes wetland restoration and enhancement on a number of suitable sites and the certification and sale of mitigation credits to applicants required to provide compensation for adverse impacts to wetland resources. Restoration sites are located within a connected system of existing wetlands that are managed by the West Eugene Wetlands Partnership. The Bank orchestrates the process of mitigation by providing compensatory mitigation in advance of approved impacts to wetlands. The Bank is a key instrument envisioned in the Plan to achieve three major objectives: (1) to

lead in the implementation of plans to restore and enhance wetland communities, (2) to provide certified compensatory mitigation credits to businesses and public agencies that seek to impact wetlands located within the Bank's service area, and (3) to provide an alternative to meet mitigation needs in a timely and economic manner

What are credits? A credit is a unit of measure representing the accrual or attainment of wetland functions at a mitigation bank. The unit of measure of function is typically indexed to the number of wetland acres that are restored, created, enhanced, or preserved. A "certified credit" results when the mitigation bank has met or exceeded the performance standards established in the Bank MOA. Once credits are certified, they are available for sale or exchange.

For more information on mitigation banks in Oregon, visit the Oregon Department of State Lands Wetlands Program web site.

Who are the players?

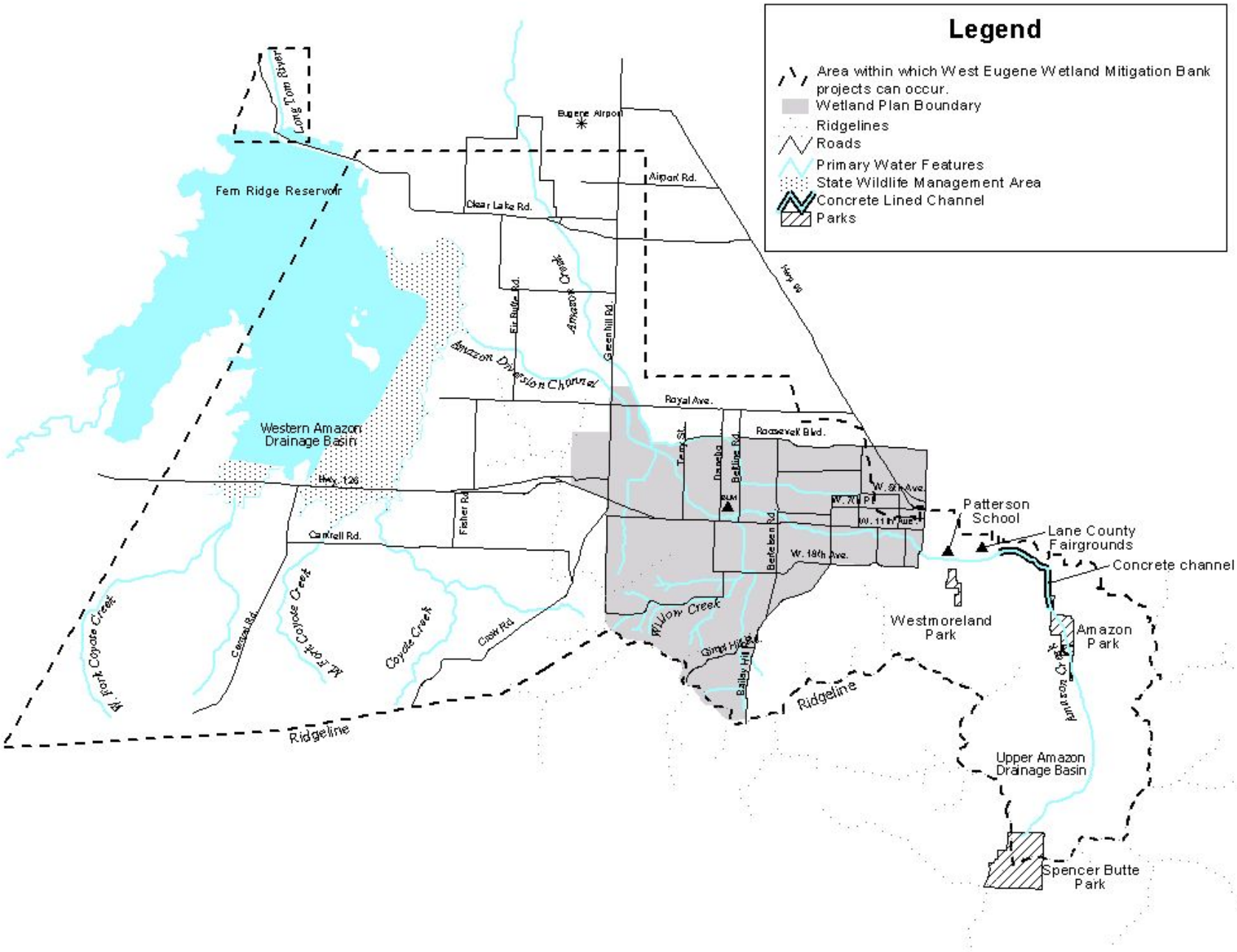
The City of Eugene is the Bank sponsor. Staff from the City of Eugene's Parks and Open Space Division, Wetlands and Open Waterways Section, manage Bank operations. The Bureau of Land Management (BLM) and The Nature Conservancy (TNC), as partners in the West Eugene Wetlands Program and as a cosigner to the Bank MOA (in the case of the BLM), provide technical assistance to develop monitoring protocols, to design restoration and enhancement projects, to construct Bank projects, and to contribute to the operation and management of the Bank.

State and federal agencies form a committee, the Mitigation Bank Review Team (MBRT), which oversees the Bank's operations. It is the responsibility of the MBRT to review and approve plans for wetland restoration and enhancement, to monitor Bank operations for compliance, and to provide technical assistance in Bank management when requested. The MBRT consists of representatives of three federal agencies (the U.S. Environmental Protection Agency, the Army Corps of Engineers, and the U.S. Fish & Wildlife Service) and two state agencies (the Oregon Division of State Lands and the Oregon Department of Environmental Quality).

Where can West Eugene Wetland Mitigation Bank projects occur?

Bank mitigation projects take place within the Long Tom River watershed, of which Amazon Creek is a tributary. Figure 1.1 shows the geographic area within which the mitigation bank operates. This area was originally identified on Map 2 of the West Eugene Wetlands Plan as the "Western Amazon Drainage Basin", and in Appendix C (Map 1) of the MOA that established the Bank.

Figure 1.1. Area within which West Eugene Wetland Mitigation Bank projects can occur.



Chapter 2: Credit and Financial Summary

Financial information for the 2003 calendar year is provided in this chapter. Included is:

1. Information regarding mitigation credit sales during 2003.
2. A list of pending bank customers and the number of credits expected in the transactions.
3. A list of annual Bank credit sales from 1994 – 2003.
4. A summary of Bank revenues and expenses.

Credit sales during 2003

At the beginning of the calendar year, the Bank had a credit balance of 0.55 credits. During 2003, the bank had an additional 13.80 credits certified for sale as a result of enhancement and restoration actions undertaken in 2002, leaving a balance of 14.35 credits. The Bank sold a total of 3.10 mitigation credits during 2003 to a combination of private and public organizations, leaving an end-of-year balance of 11.25 credits. Please refer to Table 2.1 below, for a more detailed view of the credits sales.

Table 2.1. Summary of credit sales during 2003.

	Purchase Date	Credits in Transaction	Balance
Credit balance on January 1, 2003			0.55
New credits certified for sale during 2003		13.80	14.35
Credits sold in 2003			
Lane County: Irvington Road Project	Jan. 2003	(0.14)	14.21
City of Eugene: Royal Ave Trailhead	Jan. 2003	(1.33)	12.88
Wal-Mart Stores, Inc.: Eugene Wal-Mart	Feb. 2003	(0.29)	12.59
City of Eugene: Airport 3/21 Safety Improvement Project	April 2003	(0.46)	12.13
City of Eugene: Candlelight Park	June 2003	(0.09)	12.04
David Nichols/Ross Investments: Danebo	June 2003	(0.01)	12.03
The Piculell Group: Braewood West Subdivision	June 2003	(0.13)	11.90
Oregon Dept. of Transportation: Willamette River Crossing	August 2003	(0.30)	11.60
Oregon Dept. of Transportation: McKenzie River Crossing	August 2003	(0.01)	11.59
Hammer/Oakway Golf Inc.: West side of 42nd Street adjacent to Irving Slough	August 2003	(0.04)	11.55
Brown & Associates: Amazon Heights	August 2003	(0.30)	11.25
Subtotal of credits sold in 2003		**(3.10)**	
Credit balance as of December 31, 2003			**11.25**
Credits requested for certification December, 2003		6.00	17.25
Balance forward after approval of credit request (expected in January 2004)			**17.25**

Pending credit sales

The pending sales list is an inclusive list of Bank customers who have indicated that they intend to utilize the Bank as for achieving their mitigation within the Joint Wetland Fill Permit Application. The pending sales list is not a waiting list. Customers are added to the pending sales list upon submittal of a letter of intent to use the Bank. Wetland Fill Permit applicants are encouraged to notify the Bank of their intent to purchase credits from the Bank prior to submitting their application to the regulatory agencies. Once on the pending sales list, the Bank works with the applicant to ensure that the applicant has submitted all required information concerning the impact. In addition, this list is one of the tools used by the Bank to gauge the demand for credits. At the end of 2003, the Bank had one pending request for 11.68 credits (see Table 2.2).

Table 2.2. Pending credit sales.

	Purchase Date	Credits in Transaction	Balance
Balance forward after approval of credit request			**17.25**
Pending credits sales			
Eugene Airport		(11.68)	
Subtotal of credits pending		**(11.68)**	
Estimated credit balance if pending credit sales are completed			**5.57**

Annual Bank credit sales from 1994 - 2003

Since its first credit sale in 1994, the Mitigation Bank has sold a total of 67.63 compensatory mitigation credits. See Table 2.3 for an annual break-down of credit sales.

Table 2.3. Summary of Annual Credit Sales, 1994 – 2003

Calendar Year	Total Credits Sold
1994	7.29
1995	1.50
1996	2.71
1997	15.03
1998	9.66
1999	8.08
2000	5.13
2001	7.40
2002	7.73
2003	3.10
Total	**67.63**

Financial summary

Table 2.4 summarizes the Bank's financial activity during 2003. The Bank started the calendar year with a cash balance of $988,020.88. Revenue from Credit Sales and other sources of income totaled $136,788.78. Operations and Maintenance costs totaled $261,559.48, while Capital Costs totaled $265,880.88. The end of year cash balance was $597,369.30 (Table 2.4).

Table 2.4. Financial summary for 2003.

Description of Item	Transaction Amt.	Balance
Cash Balance - January 1, 2003		**988,020.88**
Revenue		
Credits Sold (3.10) at $50,000 per credit	155,000.00	
Remove advance payment of 1.33 credits, at $50,000 per credit, for Royal Ave Trailhead Project for cash received in prior year.	(66,500.00)	
Cash refund from previous credit purchase transaction in January 2001 applied to new purchase of .29 credits, at $50,000 per credit, for Eugene Wal-Mart.	(14,500.00)	
Other Income - Cash received from installment sale.	27,636.78	
BLM: Native Seed Program	12,000.00	
USAED: Lower Amazon Creek Restoration Project Native Seed & Plant Material	2,000.00	
BLM: Hazardous Fuels reduction work for West Eugene Wetlands	4,812.00	
Interest Income	16,340.00	
Subtotal of Revenues	**136,788.78**	
		1,124,809.66
Operations and Maintenance Costs		
WMB/OM Payroll and misc. operation expenses	203,768.96	
WMB/OM Dnbo/Wllw Crk Cnflnc	5,823.08	
WMB/OM Dnbo Wst: Balboa Phs I	16,956.45	
WMB/OM Dnbo Wst Bvr Rn Phs I	5,087.77	
WMB/OM Stewart Pond Complex	2,041.52	
WMB/OM Isblle St Mngmnt Unt	2,769.72	
WMB/OM N. Grnhll Cnst Phs I	4,495.33	
WMB/OM Nolan	2,229.99	
WMB/OM Greenhill Ash Grove	1,641.59	
WMB-BLM Reimbursement	9,530.62	
WMB/OM Beaver Run Ph II	1,694.39	
WMB/OM Balboa Phase 2	365.00	
WMB/OM N Greenhill Phase 3	2,641.49	
BLM Assistance Agrmnt 2003-08	2,513.57	
Subtotal of Operations and Maintenance Costs	**261,559.48**	

Description of Item	Transaction Amt.	Balance
		863,250.18
Capital Costs		
WMB - Willow Corner	149,918.42	
Dragonfly Bend Enhancement	3,411.46	
WMB - Dragonfly Bend	9,819.82	
Wetland Mitigation Project	12,500.00	
WMB - Oxbow West	42,425.15	
WMB - Turtle Swale	1,018.85	
WMB - North Greenhill Ph 2	127.17	
WMB - Seed Procurement Prog	46,553.83	
WMB - Danebo Wst: Blboa Phs III	106.18	
Subtotal of Capital Costs	**265,880.88**	
Cash balance - December 31, 2003		**597,369.30**

Chapter 3: Capital Improvement Plan

This chapter contains a summary of the projected new mitigation bank projects for 2004 through 2006. The Capital Improvement Program for 2004 – 2006 is outlined in Table 3.1, below.

Table 3.1. Capital Improvement Program for 2004 – 2006.

Year	Project Name	Description of Actions[1]	Acres	Credits[2]
2004	Dragonfly Bend, Phase 1	Implement the first phase of the Dragonfly Bend MIP, utizling no-till site prep techniques. Plant with high diversity, native Willamette Valley wet prairie and vernal pool seed mixes.	40.00	20.00
2004	Oxbow West	Grading of small areas to refine water flow, mowing for blackberry control, solarizing/shade clothing reed canarygrass patches.	13.82	0.00
2004	Lower Amazon (Meadowlark Prairie), Unit 2	Utilize agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	52.25	0.00
2005	Dragonfly Bend, Phase 2	Implement the second phase of the Dragonfly Bend MIP, using similar techniques to Phase 1.	7.50	3.75
2005	Oxbow West	Blackberry control, remove solarization/shade cloth plots, re-seed solarization/shade cloth plots.	13.82	3.17
2005	Lower Amazon (Meadowlark Prairie), Unit 2	Continue to use agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	52.25	0.00
2005	Lower Amazon (Meadowlark Prairie), Unit 3	Utilize agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	51.22	0.00
2006	Lower Amazon (Meadowlark Prairie), Unit 2	Do final site preparation. Plant with high diversity, native Willamette Valley wet prairie seed mix. Plant plugs and bare-root stock.	52.25	20.85
2006	Lower Amazon (Meadowlark Prairie), Unit 3	Continue to use agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	51.22	0.00

[1] For a full description of the planned actions, refer to the associated MIP

[2] The number of credits is estimated based on the approved MIP. The final number of certified credits is determined by as-built conditions and the subsequent approval by the DSL and the Corps. Credits are shown as 0.0 when the specific activity (e.g., doing initial site prep) shown in any one year does not actually generate credits.

Chapter 4: Seed Procurement Program

The West Eugene Wetlands Partnership's seed procurement program continues to build. The program, guided by the standards outlined in the partnership's *1996 Wetland Plant Supply Strategy* document, seeks to ensure the availability of native plant materials for restoration efforts within the West Eugene Wetlands study area. To minimize costs, our strategy has primarily focused on collection and increase of seed stocks, rather than using labor-intensive and expensive container or bare root plantings. Seeds of most of our native wetland species are not available commercially, particularly seed of local origin that will allow us to maintain genetic integrity of local wetland plant communities. Thus, seed collection and nursery bed grow-out for seed increase are the major components of the procurement program. Additional research is ongoing, to help us to discover why we have limited success growing plants from the seeds of some species. We have been increasing the use of plugs and bare-root stock for a few species that seem to respond best to that propagation strategy.

Seed is collected and processed by field staff, contract collectors, and youth crews. In 2003, seed was collected through the combined efforts of the BLM, the City, Lane Metro and Northwest Youth Corps crews, and volunteers. Over 93 pounds of seed from 65 species of native plants were collected by the combined effort. Seed cleaning equipment and techniques continued to be refined to improve seed processing efficiency; this ongoing learning is reflected in the development of an in-house Seed Collection Manual. Currently, the majority of the seed collected annually is used for the direct seeding of mitigated areas. Appropriate species (generally the most commonly encountered species) are selected for grow-out, and then transported to contract nurseries and farmers, where seed quantity is magnified many times.

The U.S. Forest Service's J. Herbert Stone Nursery (Stone) in Jacksonville, Oregon has been growing out small seed quantities for the WEW Partnership since 1996. To date, Stone has attempted to grow approximately 45 species of native plants from the West Eugene Wetlands (Table 4.1). During 2003, Stone provided about a hundred pounds of seed, representing 8 species of native plants used in the West Eugene Wetlands. Most of the seed that is produced at the nursery is seeded onto project mitigation sites.

Pacific Northwest Natives (PNN, Albany, Oregon) has successfully grown more than 9 species from the West Eugene area in larger plots, including: *Agrostis exerata, Beckmannia syzigachne, Danthonia californica, Deschampsia cespitosa, Elymus glaucus, Epilobium densiflorum, Hordeum brachyantherum, Lupinus rivularis,* and *Plagiobothrys figuratus*. During 2003, 20 lbs of seed and a few tons of hay were purchased from PNN. All seed has gone through the Oregon State seed certification program, including germination and purity testing.

The USDA Plant Materials Center (PMC) in Corvallis studied germination of 15 species of West Eugene plants in 2003. Ten of those species germinated successfully. Seeds from 10 problematic species were grown out under controlled conditions; the seed produced by those efforts were returned to the West Eugene Wetlands program. Other species were planted in the wetlands as plugs (see Table 4.1 below).

Seed of twenty species of plants were grown into over twenty thousand seedlings (plugs) by a private nursery, as well as some grown by the USDA Plant Materials Center, in 2003. Plugs were planted in early spring and in fall on a number of restoration sites, with the help of a private nursery, Lane-Metro

Youth Corps and NYC crews, as well as staff and volunteers. Twenty-one species of seedlings and bulbs from the Oregon State Correctional Institute spent the spring at the Rachel Carson greenhouse, the summer at the City's Native Plant Nursery, and were planted in the fall of 2003 at the Turtle Swale (Phase 1 and 3), Willow Corner, and Greenhill (Phase 2 and 3) restoration sites.

Success of fall plug planting is being assessed via an experiment that monitors survival of some of the plugs. Six species of plugs were placed into 48 plots at four restoration sites. Data on plug survival in these plots is being recorded monthly for two years. Preliminary data analysis shows moderate success for plug survival.

In 2003, about 8000 ***Camassia quamash*** var. *maxima* bulbs were salvaged from private land slated for development; they were replanted on the Willow Corner restoration site. Approximately 1000 ***Camassia quamash*** var. *maxima* bulbs were salvaged from the same site and replanted at Checkermallow Access.

A program was started in 2003 with a private bulb grower to produce bulbs and bare-root stock of nine plant species, which will be available starting in 2004.

Table 4.1. Seed Increase and Plant Procurement. Each species that has been, or is currently, in grow-out is listed with its associated location of increase.

Species	Seed from J.H. Stone Nursery	Seed available from Pacific Northwest Natives	Plugs planted from OSCI	Plugs and Bare Root Species Planted	Research at PMC	Bulbs and Roots Started
Allium acuminatum			X			
Allium amplectens	Past		X		Bulbs	X
Agrostis exarata	Past	X		X		
Asclepias speciosa				X		
Aster hallii	X					
Beckmannia syzigachne	Past	X				
Brodiea coronaria			X		Bulbs	X
Camassia leichtlinii ssp. suksdorfii	Past		X			X
Camassia quamash ssp. maxima	Past		X			X
Cardamine penduliflora					X	
Carex aurea					X	
Carex densa	X		X			
Carex pellita					X	
Carex tumulicola					X	
Carex unilateralis	X		X	X		
Castilleja tenuis					X	
Clarkia amoena					X	
Collomia grandiflora					B	
Danthonia californica	X	X	X			

Species	Seed from J.H. Stone Nursery	Seed available from Pacific Northwest Natives	Plugs planted from OSCI	Plugs and Bare Root Species Planted	Research at PMC	Bulbs and Roots Started
Deschampsia caespitosa	Past	X	X	X		
Dichelostemma congestum			X			X
Downingia elegans	Past					
Downingia yina	Past					
Eleocharis acicularis					X	
Eleocharis ovata	Past					
Elymus glaucus	X	X				
Epilobium densiflorum	Past	X				
Eriophyllum lanatum	X		X	X		
Glyceria occidentalis	Past	X				
Gratiola ebracteata	Past					
Grindelia integrifolia	X					
Hordeum brachyantherum	Past	X				
Juncus acuminatus	Past			X		
Juncus bolanderi	X		X	X		
Juncus ensifolius			X	X		
Juncus nevadensis	Past		To PMC		X	
Juncus oxymeris	Past			X		
Juncus patens	Past		X	X		
Juncus tenuis	Past					
Lasthenia glaberrima					X	
Lotus formosissimus	Past				X	
Ludwigia palustris					X	
Lupinus affinis					X	
Lupinus bicolor					B	
Lupinus polyphyllus	Past		X	X		
Lupinus rivularis	Past	X	X	X		
Luzula comosa					X	
Madia elegans	Past		X		B	
Microseris laciniata	Past					
Montia linearis					X	
Myosotis laxa					B	
Orthocarpus bracteosus	Past					
Panicum acuminatum	Past		X		X	
Perideridia gairdneri				X	X	
Perideridia oregana	Past		X	X	X	

Species	Seed from J.H. Stone Nursery	Seed available from Pacific Northwest Natives	Plugs planted from OSCI	Plugs and Bare Root Species Planted	Research at PMC	Bulbs and Roots Started
Phlox gracilis					X	
Plagiobothrys figuratus	Past	X				
Plectritis congesta					X	
Potentilla gracilis	Past		X	X		
Prunella vulgaris	Past					
Ranunculus occidentalis	X					
Ranunculus orthorhynchus	Past					
Rorippa curvisiliqua	Past				B	
Rosa nutkana			X			
Saxifraga oregana				X	X	X
Sidalcea campestris	Past				X	
Sidalcea cusickii		X		X		
Sidalcea virgata	Past			X	X	
Sisrynchium idahoense	Past		X	X	X	X
Thalictrum fendlerii					X	
Tritelia hyacinthina			X		Bulbs	X
Veronica scutellata	Past					
Wyethia angustifolia	X			X		
Zigadenus venenosus			X		X	X

Chapter 5: Introduction to Site Reports

Monitoring reports have been prepared for all active West Eugene Wetlands Mitigation Bank sites. The reports are found in the following section (Part 2: Chapters 6-16). There are currently ten mitigation sites within the monitoring program. Bank sites are monitored for a period of 5 or 7 years. The duration of monitoring is dependent upon which authorizing agreement mandated Bank operations at the time the MIP was approved. During the monitoring period, a variety of assessments are made of each site throughout the year.

The monitoring reports are utilized when assessing the mitigation's success in achieving the performance criteria and the overall performance of the mitigation. Qualitative assessments are made on a quarterly basis and seek to document site hydrology, non-native vegetative cover, and wildlife use. Quantitative vegetation assessments occur in years 2, 5, and 7 (if applicable). Analysis of collected data is considered against the performance criteria outlined in the site's MIP. The progress of the site towards meeting mitigation bank standards is assessed at this time. Both qualitative and quantitative data guide the maintenance activities prescribed for each site. The methods used in the collection of all data are discussed in detail in Appendix A.

The outline of each site report is given below. The reports begin with a description of the site, its history, and management goals. This section also includes a site map. A summary of the site's progress toward meeting mitigation bank performance criteria follows. The current year's management and maintenance actions, along with recommendations for future management actions, are also included. The final section summarizes the data collection and analysis that took place in the current year.

I. Site Name

A. Site Description

1. Size
2. Ownership
3. Site Timeline
4. Location
5. Site History
6. Focus of Prescriptions
7. Site-Specific Management Goals
8. Site Map

B. 2003 Monitoring Summary

1. 2003 Management Actions
2. Management Actions for 2004

C. Monitoring Results

1. Hydrology
  a) Methods
  b) Results
2. Vegetation
  a) Methods
  b) Results
3. Wildlife Utilization

Chapter 6: Balboa Unit

A. Site Description

1. Size: 74.1 acres

2. Ownership: BLM, City of Eugene

3. *Site Timeline:* **Table 6.1**

Section	Year of Construction	Acreage	Monitoring Period
Atlantic/Pacific	1998	1 acre	1999-2005
Phase 1	1998	7 acres	1999-2003
Phase 2	1999	1.57 acres	2000-2004
Enhancement	1999	10 acres	2000-2005

4. Location

West side of Danebo Road, adjacent to the north bank of Amazon Creek. TRS, Tax lot #:17-04-33-20 tax lots: 603 and 700

5. Site History

Over the course of the last 60 years this site has been modified to serve as an airfield and a drag racing strip. Prior mitigation prescriptions were executed for the development of Ross Industrial properties located to the north and east along Danebo Ave. These prescriptions removed segments of the former airstrip runway.

6. Focus of Prescriptions

Restoration and enhancement of a large, continuous wetland tract adjacent to Amazon Creek that connects adjacent grasslands and enhances the wildlife corridor. Frontage along Amazon Creek exposes the public to a variety of wetland community types occurring within the west Eugene system. Prescriptions include removal of the remaining runway, removal of fill material, removal of noxious and invasive species, and seeding/planting of native grasses and forbs. In addition, an upland area will be enhanced to serve as a buffer from adjacent industrial land use and a trail system will be developed through the unit

7. Site-Specific Management Goals

1. Restore wet prairie and emergent wetland vegetation to areas proposed for fill removal.
2. Enhance existing wet prairie vegetation by removing invasive woody vegetation and maintaining as prairie through periodic burning and/or mowing on a portion of the wetland area that has moved from wet prairie to scrub-shrub wetland.
3. Restore native wet prairie and emergent wetland conditions by removing fill material to the original hydric soil surface.
4. Enhance habitat conditions for native wildlife species associated with wet prairie and emergent wetland habitats.
5. Maintain upland areas in native vegetation.

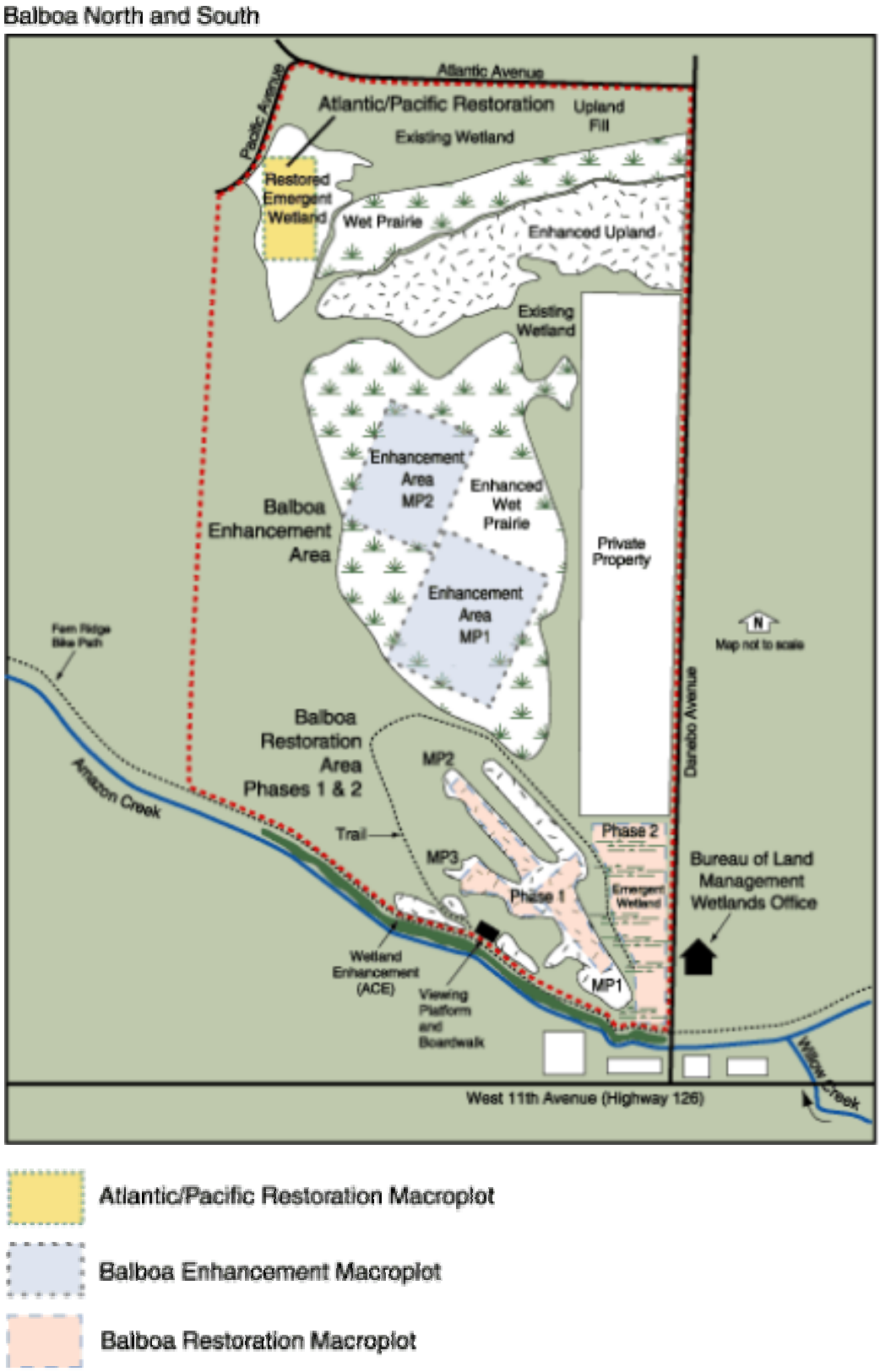


Figure 6.1. Balboa Site Map. The Enhancement area, Phases 1 and 2 restorations, and the Atlantic/Pacific restoration are labeled with their associated macroplots. Although not labeled as such, the area within the red project line that is shaded green is existing wetland.

B. 2003 Monitoring Summary

Phase 1 Restoration:

Phase 1 underwent its final year of monitoring in 2003. The site continues to exhibit wetland hydrology and the development of hydric soils. It also exceeded all vegetation standards for cover and diversity.

Phase 2 Restoration:

No quantitative vegetation monitoring data were collected for this phase in 2003. This phase continues to exhibit wetland hydrology and the development of hydric soils.

Enhancement Area:

The rare plant populations in the Balboa Enhancement appear stable, with the exception of *Erigeron decumbens* ssp. *decumbens*. The total number of *Erigeron decumbens* ssp. *decumbens* plants declined in 2003 from 156 (2002) to 124. However, the average number of flowers per reproductive plant remains stable compared to previous years. *Horkelia congesta* var. *congesta* and *Aster curtus* populations were within their historic range of variability in 2003. However, the *Horkelia congesta* var. *congesta* population increased by 5 individuals in 2003 while the frequency of *Aster curtus* decreased by 25.

The eastern half of the enhancement area was mowed in August of 2003. This area included a small section of the *Erigeron decumbens* ssp. *decumbens* population. Monitoring of this species in subsequent years may help to increase our understanding of how this species responds to mowing treatments.

Atlantic/Pacific Restoration:

No quantitative vegetation monitoring data were collected for this phase in 2003. This phase continues to exhibit wetland hydrology and the development of hydric soils. The sink hole repaired two years ago has not reformed.

1. 2004 Management Actions

Phase 1 Restoration:

1. A maintenance crew of four people spent one week weeding exotics from the restoration.
2. Populations of reedcanary grass were solarized and replanted with native seed.
3. The bike path edge was mowed to prevent exotic plant seed spread and to keep vegetation out of the bike path.

Phase 2 Restoration:

1. Maintenance crews spent 3 days hand pulling pennyroyal and other exotics from the vernal pools
2. The bike path edge was mowed to prevent exotic plant seed spread and to keep vegetation out of the bike path.

Enhancement specific actions:

1. The eastern half of the wet prairie enhancement was mowed to reduce shrubs cover.
2. Several patches of reed canarygrass were solarized and reseeded in early-fall.
3. All reed canarygrass populations were mowed prior to seed development.

Atlantic/Pacific:

1. The perimeter and wet prairie areas of the site were mowed to prevent the spread of invasive species, particularly reed canarygrass and harding grass, into the interior of the restoration.
2. Maintenance crews spent a day removing non-native species from the restoration area.

2. Management Actions for 2004

Entire Site:

1. Control reed canary-grass (*Phalaris arundinacea*) across the site to prevent its spread into the restoration and enhancement areas.
    i. Weed out small patches of reed canary-grass located along the viewing deck (along the walking trail).
    ii. Mow reed canary-grass patches to prevent seeds from spreading.
    iii. Use shade cloth on the reed canary-grass patches that are spreading into the enhancement area from the west.
2. Hand-weed pennyroyal along edges of restoration site.
3. Cut blackberries in upland prairie area as resources allow.
4. Remove pear trees located along the trail that have re-sprouted from suckers.
5. Continue to mow bike path edge (3 times)

Phase 2 Restoration:

1. Continue yearly hand weeding.
2. Retain blackberry hedge adjacent to road. Continue to trim back to prevent spread as needed.
3. Hand-weed pennyroyal along edges of restoration area.
4. Continue to remove willows and cottonwood suckers as they come up from the trees that were removed during construction.
5. Remove small patches of harding grass (*Phalaris aquatica*) on the edges of the restoration area.

Enhancement specific actions:

1. Mow/ treat areas of reed canarygrass with methods appropriate to the size of each patch (i.e., hand pull, solarize, etc.)
2. Grind tree stumps to prevent resprouting.
3. A burn has been planned for the western half of the enhancement area for the last several years, but has never been accomplished due limited fire crew availability and narrow weather prescriptions for the burn. Prescription burning is again planed for September 2004 if conditions allow, but if we are unable to accomplish the burn, the western portion of the prairie will be mowed.
4. Remove teasel and thistle present on the east and west edges of the enhancement area.
5. Control reed canary-grass (*Phalaris arundinacea*) on the perimeter of the enhancement area, particularly on the west edge where it's rapidly spreading. Use shade cloth, infrared burner, and other appropriate techniques.

Atlantic/Pacific:

1. Continue to mow the perimeter.
2. Monitor the restoration for additional sinkhole development.
3. Till portions of site where pennyroyal is dominant and plant with plugs of aggressive native species.
4. Develop a plan for more comprehensive remediation.

Table 6.2. Progress of the Balboa Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Phase 1	Goal Met?	Phase 2	Goal Met?	Atlantic/ Pacific	Goal Met?
Site status in the monitoring period	Year 5 of 5	N/A	Year 4 of 5	N/A	Year 4 of 5	N/A
Most recent quantitative data collected in year:	PI – 2003 NF - 2003	N/A	PI - 2001	N/A	PI - 2000	N/A
50% native **cover** after 2 years	98%	Yes	49%	Yes	51%	Yes
70% native **cover** after 5 years	91%	Yes	2004	TBD	2004	TBD
75% of those species occurring at a 50% **frequency** rate or greater shall be from the Native Plant list	100%	Yes	2004	TBD	2004	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	74%	Yes	2004	TBD	2004	TBD
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	13	Yes	2004	TBD	2004	TBD
Emergent/Vernal Pool: min 5 native species occurring at 10**% frequency** rate or greater	15	Yes	2004	TBD	2004	TBD

Table 6.3. Progress of the Balboa Unit enhancement towards meeting the MIP vegetation standards. The most recent data for the enhancement is compared to its relevant vegetation standards from the MIP. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MIP Vegetation Standards	Enhancement Area	Goal Met?
Site status in the monitoring period	Year 4 of 6	N/A
Most recent quantitative data collected in:	1999 (baseline data)	N/A
60% reduction of total shrub cover after 5 years	2005	TBD
70% reduction of tree density after 5 years	2005	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during a site visit in the 2nd quarter (March-May). Each phase receives an estimate for the percentage of the mitigation covered by standing water and saturated soils. Water depths were also measured monthly at 2 staff gauges.

b) Results

Observations during 2003 indicate that the hydrology of Phase 1, 2, and Atlantic/Pacific Restoration, along with the Enhancement Area continues to be sufficient to support hydric soil development. Saturated soils persisted over the site into the growing season at depths appropriate for native wetland vegetation establishment.

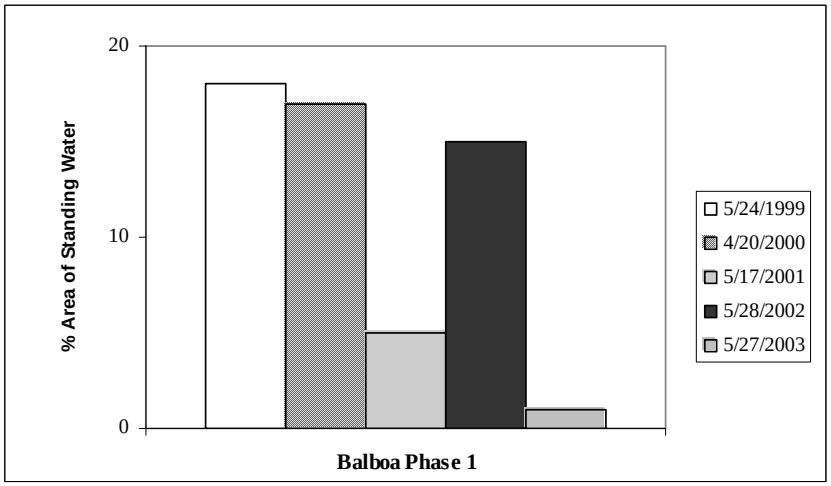


Figure 6.2. Spring standing water in Phase 1 of the Balboa Unit. Percentage of Phase 1 with standing water in the late spring over the history of the restoration.

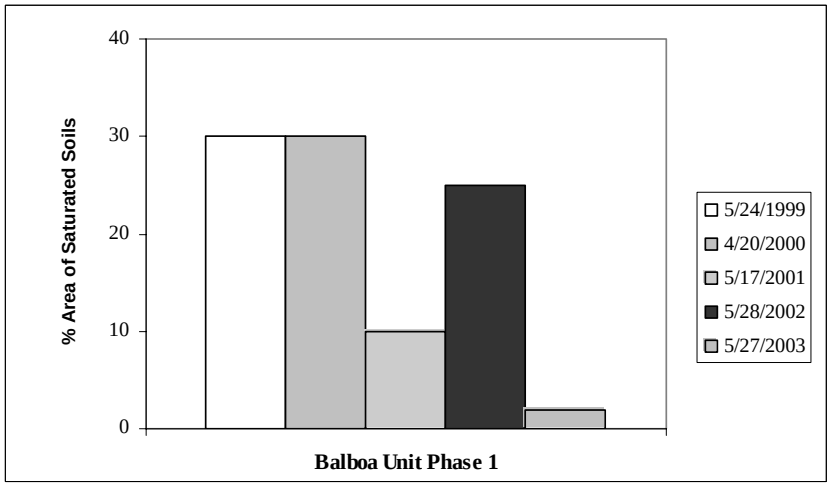


Figure 6.3. Spring saturated soils in Phase 1 of the Balboa Unit. Percentage of the Phase 1 with saturated soils in the late spring over the history of the restoration.

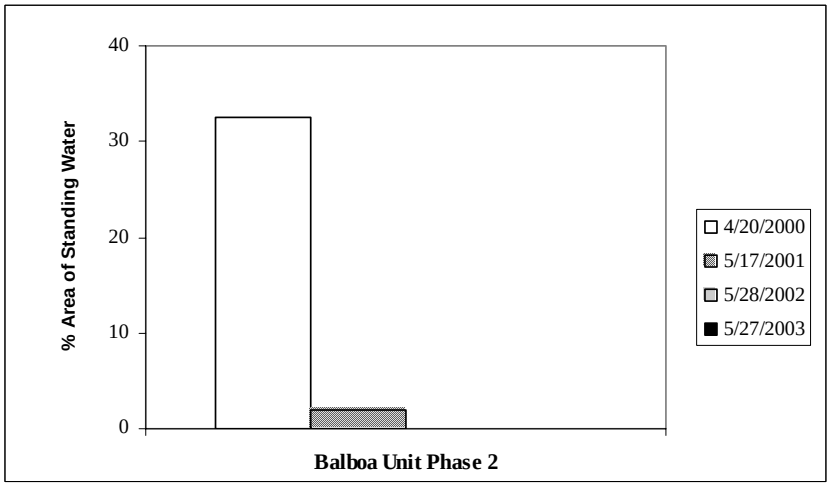


Figure 6.4. Spring standing water in Phase 2 of the Balboa Unit. Percentage of Phase 2 with standing water in the late spring over the history of the restoration.

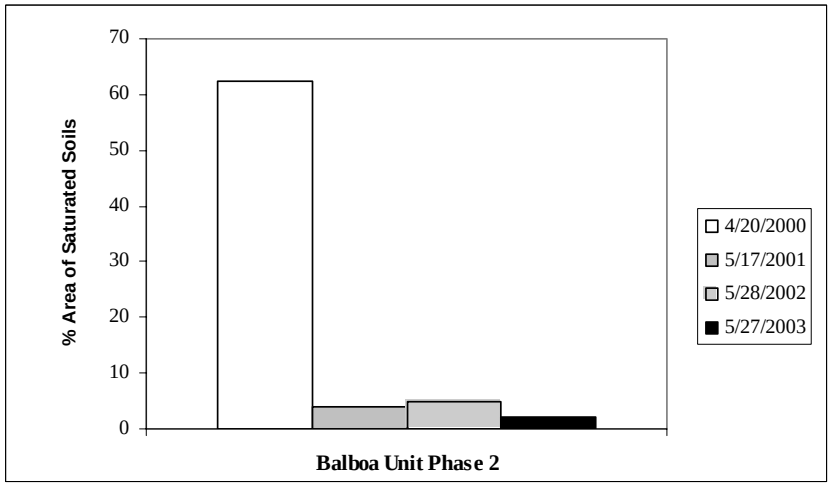


Figure 6.5. Spring saturated soils in Phase 2 of the Balboa Unit. Percentage of the Phase 2 with saturated soils in the late spring over the history of the restoration.

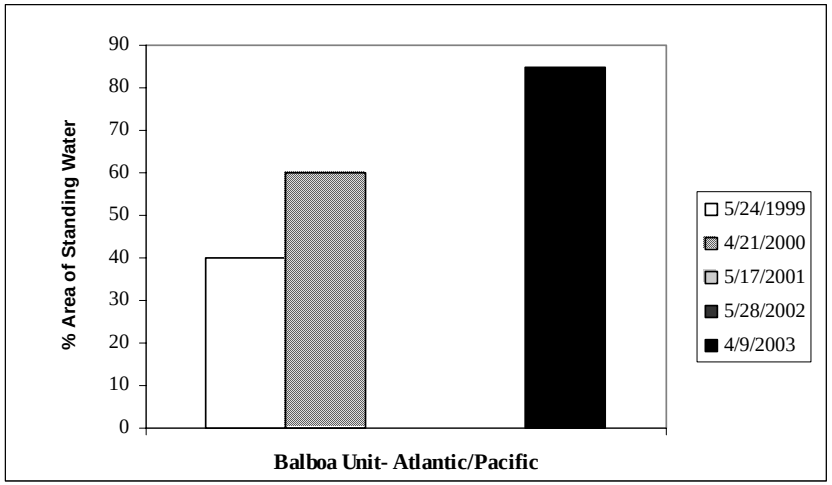


Figure 6.6. Spring standing water in the Atlantic/Pacific portion of the Balboa Unit. Percentage of Atlantic/Pacific with standing water in the early spring over the history of the restoration.

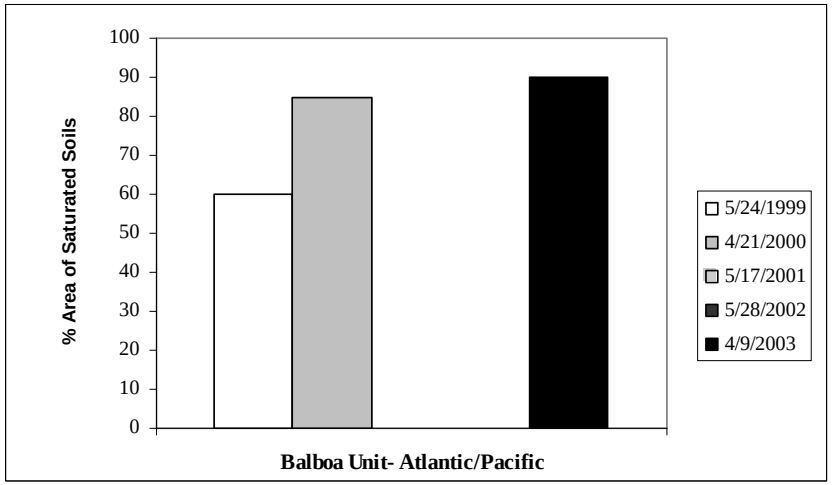


Figure 6.7. Spring saturated soils in the Atlantic/Pacific of the Balboa Unit. Percentage of the Atlantic/Pacific with saturated soils in the early spring over the history of the restoration.

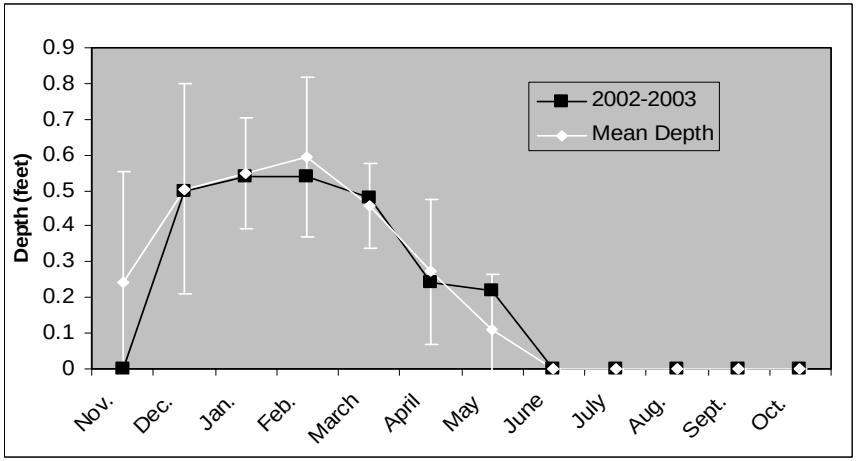


Figure 6.8. Balboa Phase 1 inundation levels in the eastern section during 2002-2003 compared to the mean and standard deviation of depths between 1998 and 2003. Depth of inundation throughout the year in the eastern section in 2002-2003. The mean and standard deviation calculated from depths observed between 1998 and 2003 are also graphed.

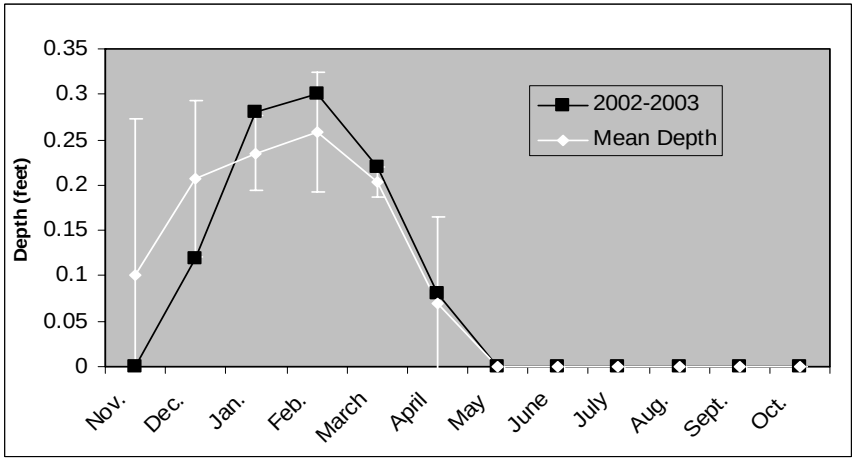


Figure 6.9. Balboa Phase 1 inundation levels in the western section during 2002-2003 compared to the mean and standard deviation of depths between 1998 and 2003. Depth of inundation throughout the year in the western in 2002-2003. The mean and standard deviation calculated from depths observed between 1998 and 2003 are also graphed for comparison.

2. Vegetation

a) Enhancement Methods

Rare species monitoring on the Balboa Unit enhancement area is required annually. Monitoring was conducted on June 26th and 27th. Three rare plant species were monitored. Data collection included:

- Frequency of *Aster curtus* in 2464 $1m^2$ quadrats
- Complete census, number of reproductive plants, and number of inflorescences per reproductive plant for *Erigeron decumbens* ssp. *decumbens*
- Complete census, numbers of seedling, vegetative, and reproductive plants, and number of inflorescences per reproductive plant for *Horkelia congesta* var. *congesta*

Qualitative monitoring for the site included an update to the plant species lists for the entire Balboa Unit. These lists can be viewed in Appendix B.

b) Results

Populations of *Horkelia congesta* var. *congesta* and *Aster curtus* on the Balboa Enhancement appear stable. The population of *Horkelia congesta* var. *congesta* remains within its historic range of variability, with an increase of 5 plants from 2002 to 2003. The *Aster curtus* population also remains within its historic range of variability; however, its frequency declined in 2003 from 195 in 2002 to 170.

The overall number of *Erigeron decumbens* ssp. *decumbens* crowns continues to decline. The total number in 2003 was 124, down from 394 in 1999. Management treatments of either burning or mowing will take place in the fall of 2004 to remove woody vegetation. The population will continue to be monitored before and after these treatments.

The data collected in 1999 was before the initial woody vegetation removal, and can therefore be used to begin to investigate the effects of woody vegetation removal on these populations. It appears that the removal of trees and shrubs has not adversely impacted the populations *Horkelia congesta* var. *congesta* or *Aster curtus* and has likely helped to promote the population expansion of *Aster curtus*. Despite the continued decline of *Erigeron decumbens* ssp. *decumbens*, the removal of woody vegetation may have had some influence on the number of flowers produced per crowns of *Erigeron decumbens* ssp. *decumbens*. The flowering of *Erigeron decumbens* ssp. *decumbens* has increased by 31%.

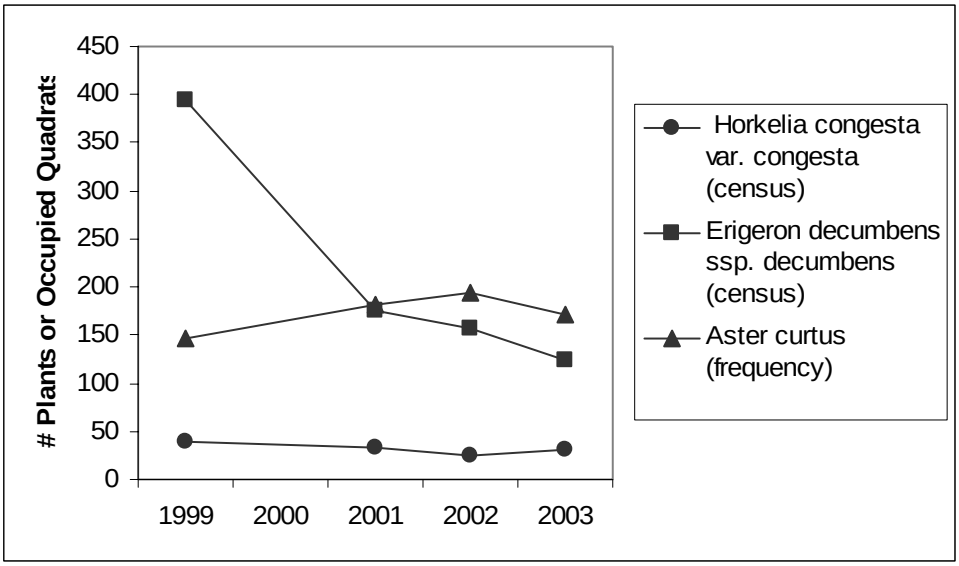


Figure 6.10. Rare plant population trends on the Balboa enhancement. Census data for *Horkelia congesta* var. *congesta* and *Erigeron decumbens* ssp. *decumbens* and frequency data for *Aster curtus* are plotted from 1999-2003, excluding 2000.

Erigeron decumbens ssp. *decumbens*
The number of *Erigeron decumbens* ssp. *decumbens* plants observed from 2002 to 2003 by 34 individuals. The total number of flowers was lower than in any other year sampled.

Table 6.4. *Erigeron decumbens* ssp. *decumbens* population trends from 1999 and 2001-2003. Attributes for the *Erigeron decumbens* ssp. *decumbens* population on the Balboa Unit enhancement are given for 1999 and 2001-2003.

Erigeron decumbens ssp. decumbens	**1999**	**2000**	**2001**	**2002**	**2003**
Total # of plants	394	No data	175	156	124
% of plants reproductive	71.1%	No data	48.6%	96.7%	94.3%
Avg. # of flowers per reproductive plant	4.8	No data	11.2	14.4	11.0
Total # flowers	1349	No data	1736	2175	1292

Horkelia congesta var. *congesta*
The *Horkelia congesta* var. *congesta* population increased by 5 individuals from 2002 to 2003. All other measures remain within the population's historic range of variability.

Table 6.5. *Horkelia congesta* var. *congesta* population trends from 1999 and 2001-2003. Attributes for the *Horkelia congesta* var. *congesta* population on the Balboa Unit enhancement are given for 1999 and 2001-2003.

Horkelia congesta var. congesta	**1999**	**2000**	**2001**	**2002**	**2003**
Total # of plants	39	No data	33	25	30
% of plants reproductive	51.3%	No data	48.5%	96.0%	63.3%
Avg. # of flowering stems per reproductive plant	1.55	No data	1.87	1.87	1.63
Total # flowering stems	31	No data	30	45	31

Aster curtus
The *Aster curtus* population increased in frequency from 1999 to 2002, but saw a decrease in 2003 by 25 occurrences. However, the frequency in 2003 (170) is greater than in 1999 (147) when baseline data were collected.

Table 6.6. *Aster curtus* frequency on the Balboa Unit enhancement from 1999 to 2003

Aster curtus	**1999**	**2000**	**2001**	**2002**	**2003**
Total # of plots occupied	147	No data	182	195	172

c) Phase 1 Methods
2003 represented the last year within the 5-year monitoring period for the Balboa Phase 1 restoration project. Both point-intercept data and nested frequency data were collected this summer to complete the phase's final monitoring. Point-intercept data were collected June 5, 6, and 10-13 from one macroplot, with a total of 201 points sampled. Nested frequency data were collected over the same time period from 107 plots. In addition, a species list was compiled for the entire site and can be viewed in Appendix B.

d) Phase 1 Results
The total percent cover and the total native cover did not change significantly from 2001 to 2003 (Figure 6.11). The non-native total percent cover increased significantly from 3.7% ($2.2\% < \mu < 5.1\%$) to 16.2% ($12.1\% < \mu < 21.1\%$). Despite the increase in non-native vegetation, the site meets the mitigation bank standard of 70% native vegetation of with 91% of the total cover being native.

A total of 116 species were detected during nested frequency data collections. Of those 116 species, 67 were from the native plant list of West Eugene, 45 were not native, and 4 we could not be identified to the species level. Table 6.7 lists the species observed with a frequency of greater than 10%. Habitat information is also provided for the native species. Of the native species occurring in Phase 1 with a frequency of greater than 10%, 13 were wet prairie species and 15 were vernal pool or emergent species. Thus, the mitigation bank goal of 10 wet prairie species and 5 vernal pool species with greater than 10% frequency was met.

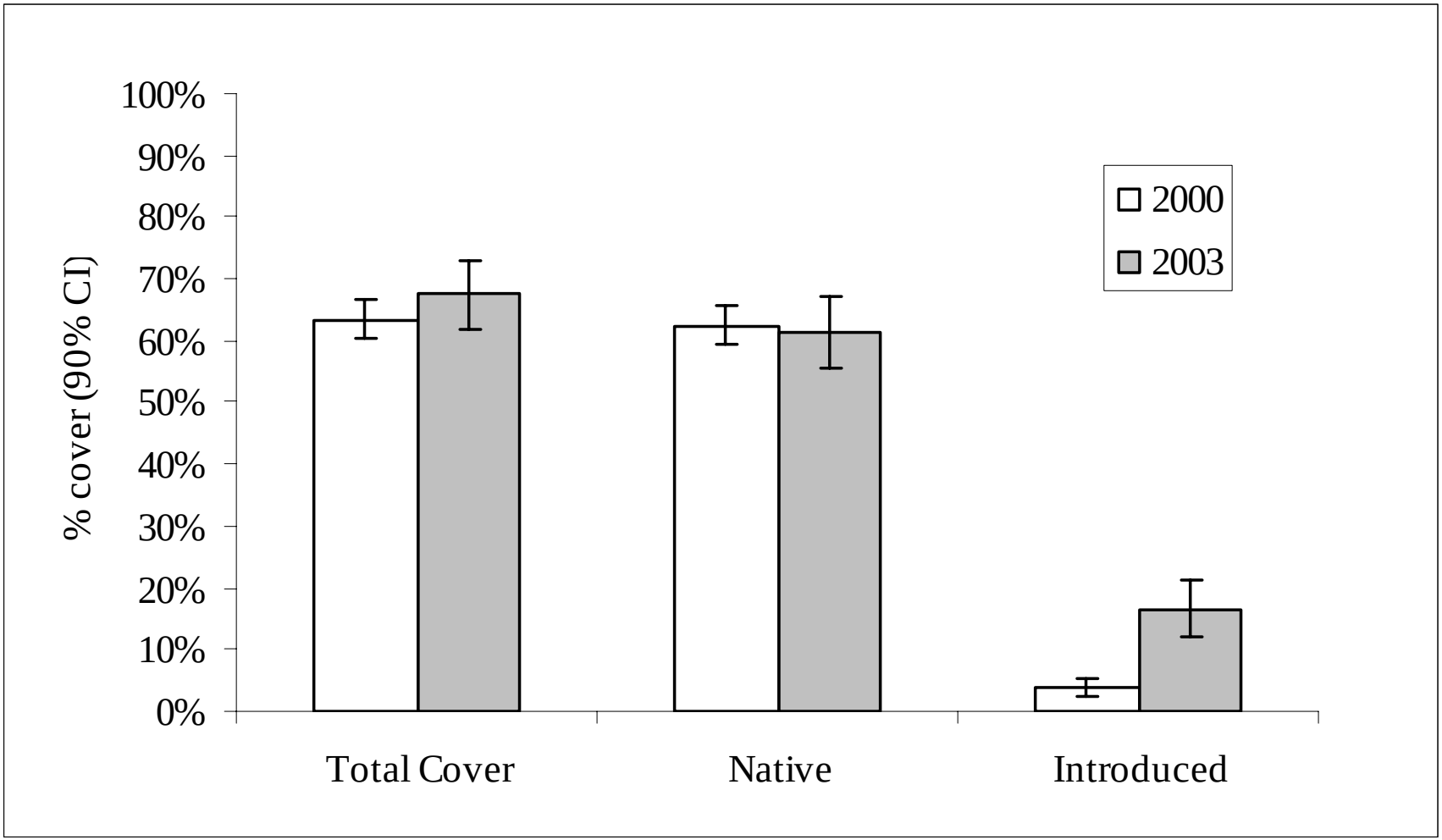


Figure 6.11. Percent cover of ground cover guilds at the Balboa Unit Phase 1. Total percent cover, native percent cover and introduced percent covers are graphed for the 2nd and 5th years of the monitoring period for the Phase 1 section of the Balboa Unit.

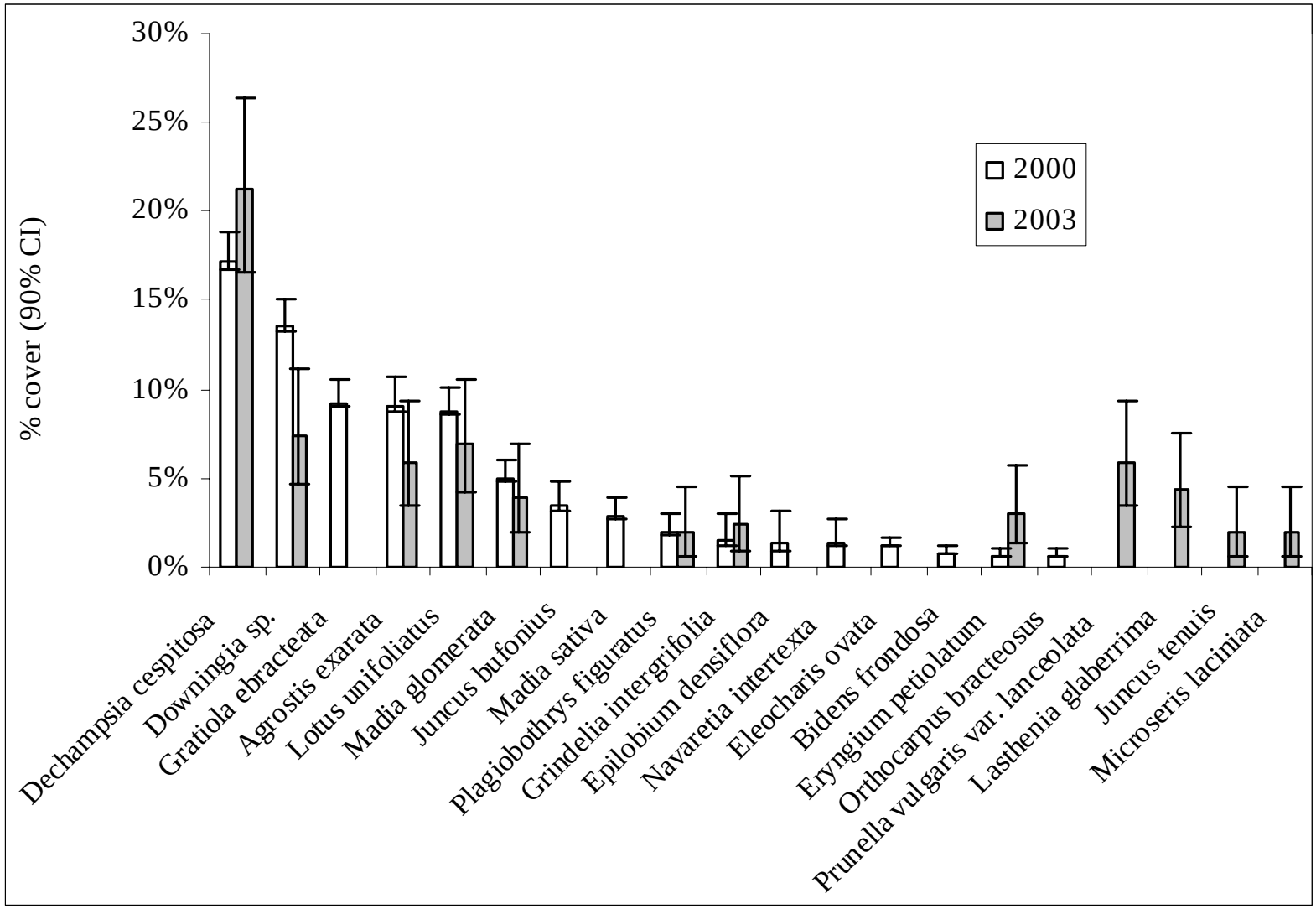


Figure 6.12. Native species on the Phase 1 section of the Balboa Unit with > 1% cover. All native species in 2002 with greater than 1 percent cover are graphed for 2000 and 2003. All species shown in the graph are native. No introduced species had a cover value of > 1%.

Table 6.7. Species Present with Greater than 10% Frequency in Balboa Phase 1. All species present with > 10% frequency in Balboa Phase 1 are listed with their origin and 90% confidence limits. Habitat information is also listed for native species where 'VP/E' represents vernal pool and emergent habitats and 'WP' corresponds to wet prairie habitat.

Scientific Name	Origin	Frequency	Lower Limit	Upper Limit	Habitat
Navarretia intertexta ssp. intertexta	N	66.36	58.10	73.92	VP/E
Deschampsia cespitosa	N	62.62	54.26	70.44	WP
Plagiobothrys figuratus	N	55.14	46.73	63.33	VP/E
Lotus unifoliolatus	N	53.27	44.88	61.53	WP
Madia glomerata	N	52.34	43.96	60.62	VP/E
Grindelia integrifolia	N	51.40	43.04	59.71	VP/E
Microseris laciniata	N	48.60	40.29	56.96	VP/E
Downingia sp.	N	45.79	37.57	54.20	VP/E
Prunella vulgaris	N	39.25	31.32	47.64	WP
Agrostis exarata	N	38.32	30.44	46.69	VP/E
Centaurium erythraeae	I	37.38	29.56	45.74	
Eryngium petiolatum	N	36.45	28.69	44.78	VP/E
Gratiola ebracteata	N	36.45	28.69	44.78	VP/E
Madia sativa	N	36.45	28.69	44.78	WP
Lasthenia glaberrima	N	34.58	26.95	42.87	VP/E
Anthoxanthum odoratum	I	30.84	23.50	38.99	
Hypochaeris radicata	I	30.84	23.50	38.99	
Vicia tetrasperma	I	28.04	20.96	36.05	
Parentucellia viscosa	I	26.17	19.28	34.08	
Juncus tenuis	N	24.30	17.62	32.08	WP
Danthonia californica	N	24.30	17.62	32.08	WP
Mentha pulegium	I	24.30	17.62	32.08	
Orthocarpus bracteosus	N	22.43	15.97	30.07	WP
Daucus carota	I	22.43	15.97	30.07	
Potentilla gracilis	N	21.50	15.16	29.06	WP
Eleocharis acicularis	N	20.56	14.35	28.04	VP/E
Leontodon taraxicoides	I	19.63	13.54	27.02	
Lythrum portula	I	18.69	12.74	25.99	
Eleocharis obtusa	N	16.82	11.16	23.92	VP/E
Rumex acetosella	I	16.82	11.16	23.92	
Geranium disectum	I	15.89	10.38	22.87	
Bromus hordeaceus	I	14.95	9.61	21.82	
Epilobium densiflora	N	14.02	8.84	20.76	WP
Galium parisiense	N	14.02	8.84	20.76	WP
Epilobium brachycarpum	N	14.02	8.84	20.76	WP
Holcus lanatus	I	14.02	8.84	20.76	
Eriophyllum lanatum var. lanatum	N	13.08	8.09	19.70	WP
Beckmannia syzigachne	N	12.15	7.34	18.62	VP/E
Rubus armeniacus	I	12.15	7.34	18.62	
Phlox gracilis	N	11.21	6.60	17.54	WP
Cicendia quadrangularis	N	11.21	6.60	17.54	VP/E
Bidens frondosa	N	10.28	5.87	16.44	VP/E

3. Wildlife Utilization

The Balboa Unit remained a popular site for wildlife and the species sighted were similar to those of previous years. Canadian geese, mallards, blue heron, deer and killdeer were the most commonly sighted waterfowl. In addition to waterfowl, common garter snakes and Pacific treefrogs were also observed on the site. A great egret was also seen again in the northwest wet area.

Chapter 7: Beaver Run Unit

A. Site Description

1. Size: 23.3 acres

2. Ownership: BLM

3. *Site Timeline:* **Table 7.1**

Section	Year of Construction	Monitoring Period
Enhancement	1998	1999-2004
Phase 1	1998	2000-2004
Phase 2	1999	2000-2004

4. Location

The Beaver Run Unit of the Danebo West Management Area is located to the south of Amazon Creek, north of W. 11th Street, and west of Danebo Avenue, Eugene, Or.

5. Site History

Woody vegetation was invading the existing wet prairie within which there are documented populations of rare herbaceous species. Soil, concrete and rubble have been historically dumped in a 2-acre area on site. Currently three outfall pipes drain the site directly into Amazon Creek. Prior to channelization, Amazon Creek flowed through the site. Remnants of the historic Amazon channel remain on site. These fragmented reaches exhibit oxbow-like characteristics. The resident beaver population was constructing dams and actively altering site hydrology resulting in a transition of community types including a net loss of wet prairie. An atypical hydrologic condition existed as surface water was conveyed across the unit during summer months introduced through irrigation of lands upstream. Coupled with beaver activity, site hydrology was being adversely impacted in the context of the goals established for protection of this unit within the WEWP.

6. Focus of Prescriptions

Restoration and enhancement focus on the emergent and wet prairie communities. Site hydrology is still in transition because of external influences, but fill materials were removed. Vegetative treatments include removal of invasive herbaceous and woody species across the unit and seeding of native grasses and forbs. The overall goal for the project is to stabilize site hydrology so hydrologic conditions favor perpetuation of a diverse wet prairie community. Additional goals for the Unit include: enhancement of the woodland adjacent to the levee, enhancement of the emergent pools, and enhancement of habitat for resident wildlife (common western garter snake, beaver, great blue heron, red wing blackbird, western pond turtle).

7. Site-Specific Management Goals:

1. Restore wet prairie vegetation to areas of proposed fill removal.
2. Establish hydrophytic vegetation within the restoration and enhancement areas by planting, seeding and/or natural colonization.

3. Enhance wet prairie vegetation by removing woody vegetation and maintaining as prairie through periodic mowing on a portion of the wetland area that has transitioned from wet prairie to scrub-shrub wetland.
4. Establish wetland hydrology within the restoration area.
5. Improve overall hydrology across the Unit by reestablishing east to west cross-site flow.
6. Stabilize hydrology across the Unit.
7. Enhance habitat conditions for native wildlife species associated with wet prairie and emergent wetland habitats.
8. In Phase 2, explore the usefulness of biosolid application in the establishment of native wetland plants.

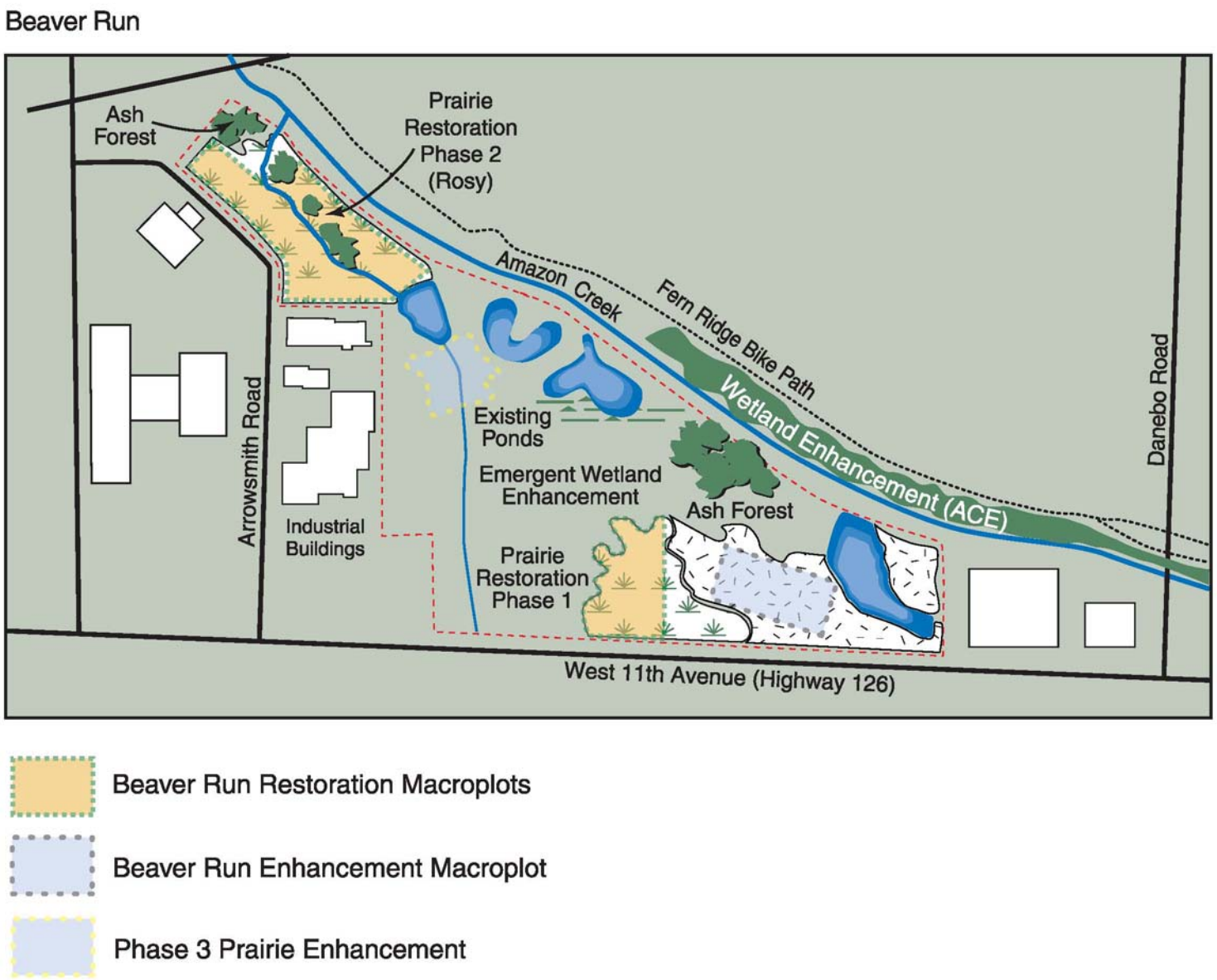


Figure 7.1. Beaver Run Site Map. The Enhancement area and the Phases 1 and 2 restorations are labeled with their associated macroplots. The area under the enhancement area and both phases are wet prairie habitat.

B. 2003 Monitoring Summary

All phases of Beaver Run support hydric soils and vegetation; however, reed canarygrass remains a threat to the mitigations. Maintenance crews solarized the restoration perimeter to prevent the spread of reed canarygrass into the restoration. Additionally, they mowed the areas outside the enhancement and restoration to prevent seed set. Final quantitative vegetation data will be collected in 2004; however, it is uncertain if Phase 1 will pass the vegetation standards due to the invasion of reed canarygrass and other exotics. Remedial action may be necessary.

1. 2003 Management Actions

Entire site:

1. Maintenance crews spent 20 hours mowing reed canarygrass in the site throughout the growing season to prevent seed set.
2. Crews spent 3 days hand weeding pennyroyal.
3. Crews spent 3 days using solarization to remove reed canarygrass.

2. Management Actions for 2004

Entire site:

1. Continue to control Harding grass (*Phalaris aquatica*) to prevent its spread.
2. Continue to mow all reed canarygrass (*Phalaris arundinacea*) before it goes to seed.

Phase 1 Restoration

1. Continue to closely monitor for reed canarygrass establishment in this area and remove it where it occurs.
2. Continue to mow perimeter to control invasive grasses (approximately 3 times per year).
3. Remove willow and cottonwood that is coming up along the central channel.
4. Remove hairy cat's ear (*Hypochaeris radicata*), hairy hawkbit (*Leontodon taraxacoides*), and large barnyard grass (*Echinochloa crus-galli*) patches establishing along the street edge of the site.
5. Hand weed scattered pennyroyal (*Mentha pulegium*) in the pool area.

Phase 2 Restoration Area:

1. Continue to hand weed and treat reed canarygrass and Harding grass by cutting, digging, and/or solarizing.
2. Hand weed reed canarygrass patches that are small enough to remove that way.
3. Remove scattered Scot's broom (*Cytisus scoparius*) located along the central swale.

Phase 1 Enhancement Area (eastern half of site):

1. Continue to mow woody vegetation in enhancement area to maintain prairie structure. Retain the larger Suksdorf's hawthorn (*Crataegus suksdorfii*) that were intentionally left in this area.
2. Continue to remove large concentration of teasel (D*ipsacus sylvestris*) and Harding grass (*Phalaris aquatica*) located on the eastern edge of the site near the remnant channel.

Phase 3 (Area between Phase 1 and Phase 2)

1. Continue to turn and compost reed canarygrass piles that were created in 2002.
2. Hand weed scattered reed canarygrass patches that have come up in the area where the sod mats were rolled off in 2002.
3. Explore the potential of continuing to remove the reed canarygrass in phases using the following process:
    1. Roll off reed canarygrass sod mats as was done in 2002 and create new compost piles.
    2. Spread previous year's compost onto the area where mats are removed.
    3. Use sunburst to sterilize the soil (kill remaining reed canarygrass rhizomes and seed)

4. Seed area with low-diversity, highly aggressive wet prairie mix.
5. Follow-up with hand weeding.

Beaver Pond Area:

1. Revisit in the winter to observe hydrology in the pond area.
2. Based on winter hydrology, determine if its necessary to replace the current water valve with a stand pipe to provide better control of water level in the pond.

Table 7.2. Progress of the Beaver Run Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Phase 1	Goal Met?	Phase 2	Goal Met?
Site status in the monitoring period	Year 6 of 6	N/A	Year 5 of 5	N/A
Most recent quantitative data collected in year:	PI - 2000	N/A	PI - 2001	N/A
50% native cover after 2 years	61%	Yes	59%	Yes
70% native cover after 5 years	2004	TBD	2004	TBD
75% of those species occurring at a 50% frequency rate or grater shall be from the Native Plant list	2004	TBD	2004	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2004	TBD	2004	TBD
Wet Prairie: minimum of 10 native species occurring at 10% frequency rate or greater	2004	TBD	2004	TBD
Emergent: min 5 native species occurring at 10% frequency rate or greater	2004	TBD	2004	TBD

Table 7.3. Progress of the Beaver Run Unit enhancement towards meeting the MIP vegetation standards. The most recent data for the enhancement is compared to its relevant vegetation standards from the MIP. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MIP Vegetation Standards	Enhancement Area	Goal Met?
Site status in the monitoring period	Year 5 of 5	N/A
Most recent quantitative data collected in:	2000	N/A
50% reduction of total shrub cover after 2 years	50%	Yes
50% reduction of tree density after 2 years	86%	Yes
60% reduction of total shrub cover after 5 years	2004	TBD
70% reduction of tree density after 5 years	2004	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits in the 2nd quarter (April-June). These estimates were made separately for the main Phase 1 restoration area and the Phase 2 restoration area. Water depths were measured monthly at 1 staff gauge.

b) Results

The extent and duration of water at Phase 1, Phase 2, and the Enhancement Area of the Beaver Run Unit have been and continue to be sufficient for the development of hydric soils and wetland vegetation (Figures 7.2 – 7.6). The areas of saturation and inundation remain relatively constant from year to year. Phase 1 and the Enhancement contain mostly wet prairie and vernal pool habitats, while Phase 2 has some wet prairie, but is largely vernal pool and emergent habitats.

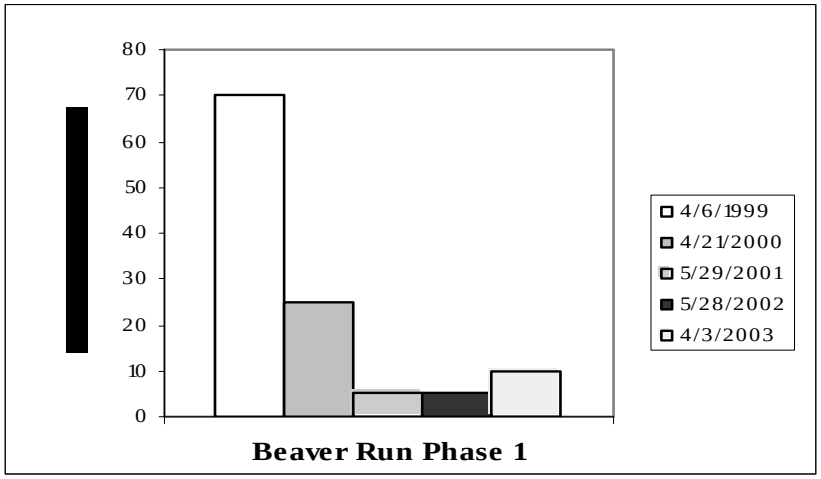


Figure 7.2. Spring standing water in Phase 1 of the Beaver Run Unit. Percentage of Phase 1 with standing water in the early spring over the history of the restoration.

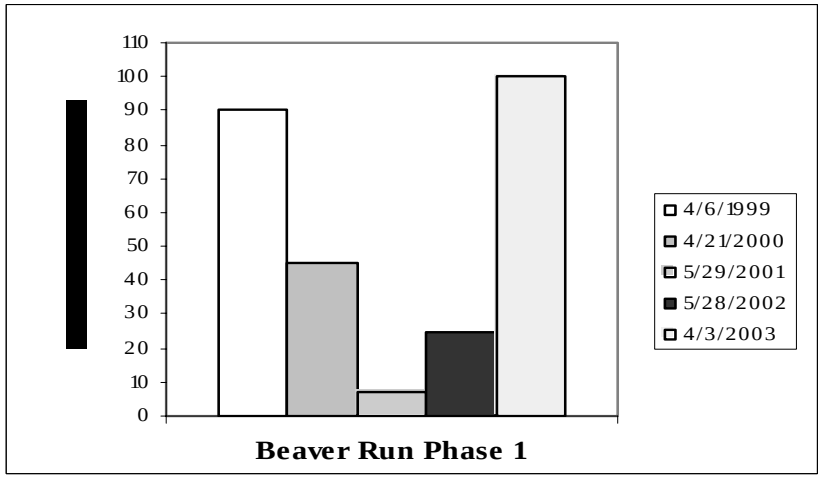


Figure 7.3. Spring saturated soils in Phase 1 of the Beaver Run Unit. Percentage of the Phase 1 with saturated soils in the early spring over the history of the restoration.

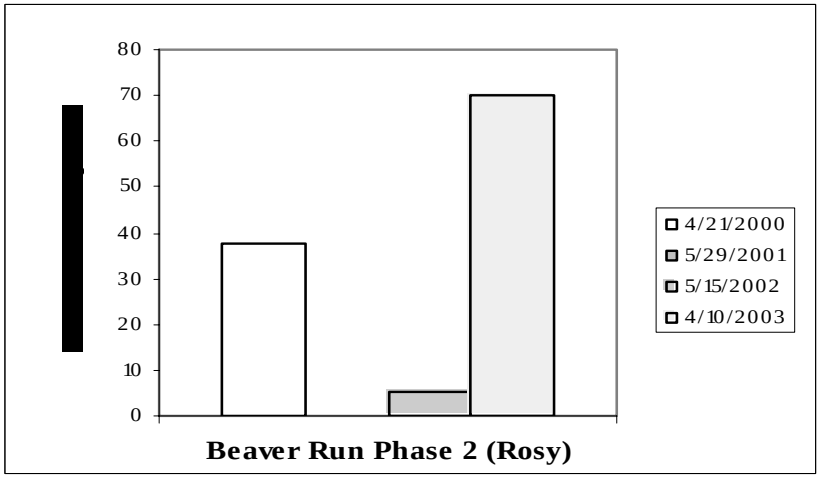


Figure 7.4. Spring standing water in Phase 2 of the Beaver Run Unit. Percentage of Phase 1 with standing water in the early spring over the history of the restoration.

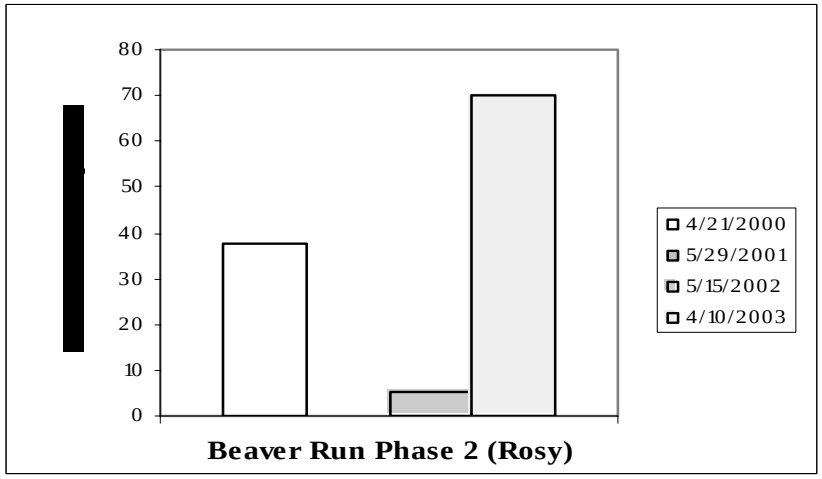


Figure 7.5. Spring saturated soils in Phase 2 of the Beaver Run Unit. Percentage of the Phase 1 with saturated soils in the early spring over the history of the restoration.

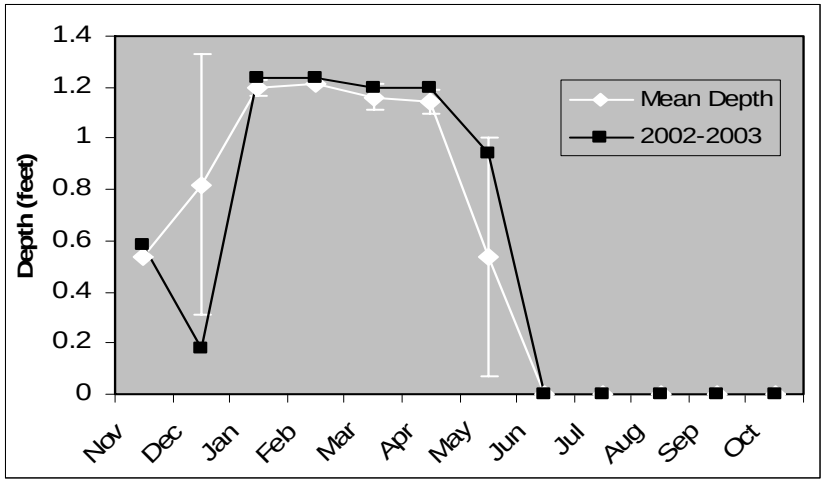


Figure 7.6. Beaver Run Unit—Phase 2 inundation levels in the western section during 2002-2003 compared to the mean depth between 1999 and 2003. Depth of inundation throughout the year in the western vernal pool in 2002-2003. The mean calculated from depths observed between 1998 and 2003 are also graphed for comparison. Error bars represent one standard deviation from the mean.

2. Vegetation

a) Methods

No quantitative monitoring was scheduled this year on any section of the Beaver Run Unit. Routine qualitative monitoring, such as weed mapping and photopoints, was completed. Point-intercept and nested frequency for the entire site are scheduled for the summer of 2004. Species lists were updated for each section and the results can be viewed in Appendix B.

3. Wildlife Utilization

Historically, many species of wildlife has been observed utilizing this site (see previous Annual Reports). Past sightings included great blue herons, Canadian geese, mallards, orange-crowned warblers, beaver, western pond turtles, and red-winged blackbirds

Chapter 8: Danebo Unit

A. Site Description

1. Size: 10.1 acres

2. Ownership: BLM

3. *Site Timeline:* **Table 8.1**

Section	Years of Construction	Acreage	Monitoring Period
Restoration	1996 and 1997	1.9	1996-2003

4. Location

The Danebo Unit is located on the north side of Amazon Creek between Beltline Rd and Danebo Ave.

5. Site History

Historically the site was used for agricultural purposes. Wetlands on the site were also impacted by the channelization of Amazon Creek.

6. Focus of Prescriptions

Prescriptions focus on restoration (1.9 acres in the western section) and enhancement (remaining acreage in the eastern portion) of emergent and wet prairie communities. Prescriptions were realized through sod removal, installation of a water control structure, and seeding of native species. An additional 0.21 acres of wetland were restored in 1997 in the project area adjacent to the Fern Ridge Bike Path. Hydric soils were exposed to an equivalent elevation as the ground plain of the adjacent wetland.

7. Site-Specific Management Goals

1. Protect and maintain the existing prairie on the east portion of the site, and expand it by removing invading shrubs and blackberry patches.
2. Enhance the existing emergent wetland in the former pasture on the west portion of the site with grading and hydrologic alterations.
3. Expand seasonal emergent wetland communities adjacent to the existing emergent wetland.
4. Provide opportunities to promote research and environmental education.

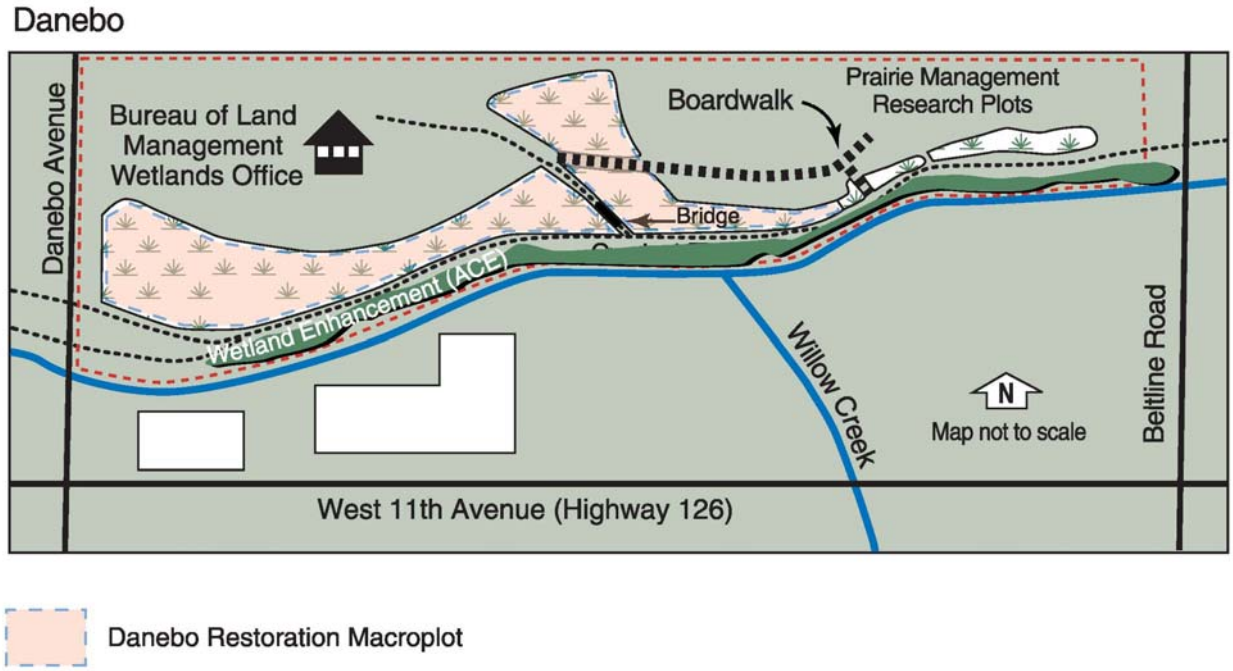


Figure 8.1. Danebo Site Map. The restoration area is labeled with its associated macroplot (shaded pink).

B. 2003 Monitoring Summary

The restoration continues to function as a seasonal emergent and vernal pool wetland in its western and eastern portions and as wet prairie in the central and northeastern areas. Hydrologic conditions remain satisfactory for the maintenance and development of hydric soils. Standing water persisted in the eastern portion at depths of 1.5 feet through May. In the entire restoration, 85% of the soils were saturated to the surface in April of 2003—much more than 15% of the growing season.

The vegetative mitigation bank standards set forth for this site include goals for the total cover and composition of vegetation, the frequency of species and the long-term success of the initial seeding. Point-intercept data were collected in 2002 to monitor the site's progress toward the goal for percent cover. These data show that the Danebo Unit is well above the standard of 70% native cover, with 83% native cover five years after restoration. Seeding success was also evaluated against the standard that states, '70% of the planted species shall be alive and present at the end of the five year monitoring period.' Of the species planted at Danebo, 83% are present.

Nested frequency data were collected in 2003. These data are used to rate the site according to three mitigation bank standards for species diversity as well as the prominence of dominant species. The first standard states that 75% of species with a frequency of 50% or greater should be native. Five species had a frequency of 50% or greater. Of these 5 species, 3 were native (60%). However, of the species with a frequency of 35% or greater 7 of 9 were native (78%). This standard is not a good measure of the site's success because it is relatively small (approximately 1.9 acres) with emergent, vernal pool, and wet prairie habitats. Few species, if any, are able to persist and dominate in all three of these habitats, which should, and appear to, make the number of species with greater than 50% frequency quite low.

The last two standards require that 1) a minimum of 10 native wet prairie species occur at 10**%** frequency greater and 2) a minimum of 5 native vernal pool or emergent species occur at a 10% frequency rate or greater. Danebo had 10 wet prairie species and 9 vernal pool or emergent species occurring a frequency of 10% or greater.

2003 Management Actions:

1. Maintenance crews spent three days hand weeding the restoration to remove non-native species.
2. One day was spent solarizing reed canarygrass.
3. The perimeter of the site was mowed twice, once in the spring and then again in the summer.
4. Approximately 50 plugs each of *Juncus bolanderi*, *Juncus ensifolius*, *Juncus nevadensis var. nevadensis*, *Juncus patens*, *Juncus tenuis*, and *Juncus effusus* were planted in the vernal pool and emergent areas in October.

Management Actions for 2004

1. The perimeter will be mowed to prevent the spread of exotics along the bike path from invading the restoration and enhancement areas.
2. 2003 is the final year of monitoring for the Danebo restoration. Further management and maintenance will be performed by the BLM.

Table 8.2. Progress of the Danebo Unit towards meeting the MOA vegetation standards. The most recent data is compared to its relevant vegetation standards from the Bank MOA

Vegetation Standard in MOA	Site Status in Year 8 (of 8)	Goal Met?
70% native **cover** after 5 years	83%	Yes
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	3 of 5 = 60%	No
70% of the planted species shall be alive and present at the end of the five year monitoring period	29 of 35, or nearly 83%	Yes
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	10	Yes
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	9	Yes

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits, the first in early spring and the second in late fall. Water depths were measured monthly at 2 staff gauges.

b) Results

Standing water and saturated soils continue to be observed in similar locations on the site. Inundation is deeper in the eastern section of the restoration than in the western. Depths reach up to 2 feet and are kept from getting deeper by a headgate that drains into the Amazon channel. The western pool reached

1.0' last spring. The site continues to display conditions that are sufficient to support hydric soils and wetland vegetation.

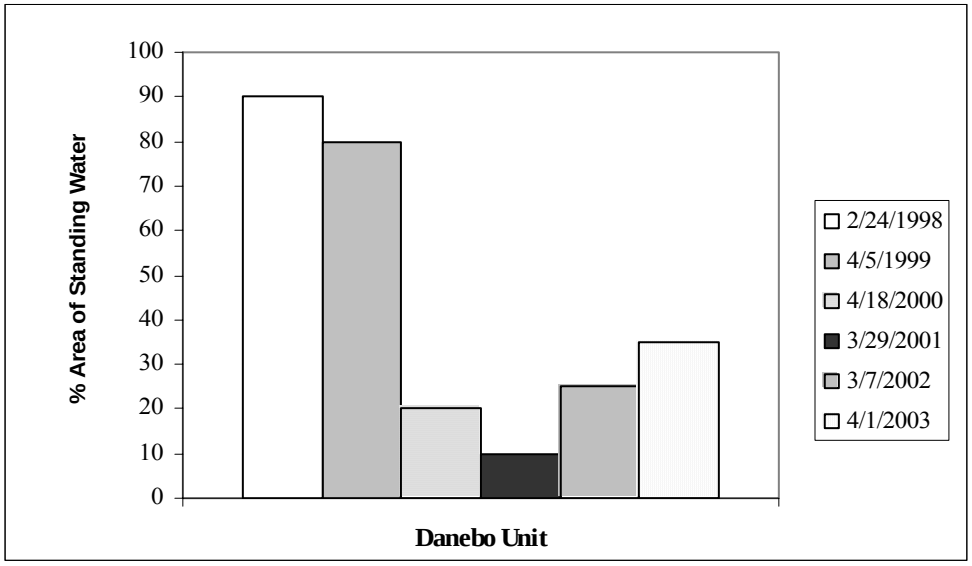


Figure 8.2. Spring standing water in the Danebo Unit. Percentage of the Danebo Unit with standing water in the early spring over the history of the restoration.

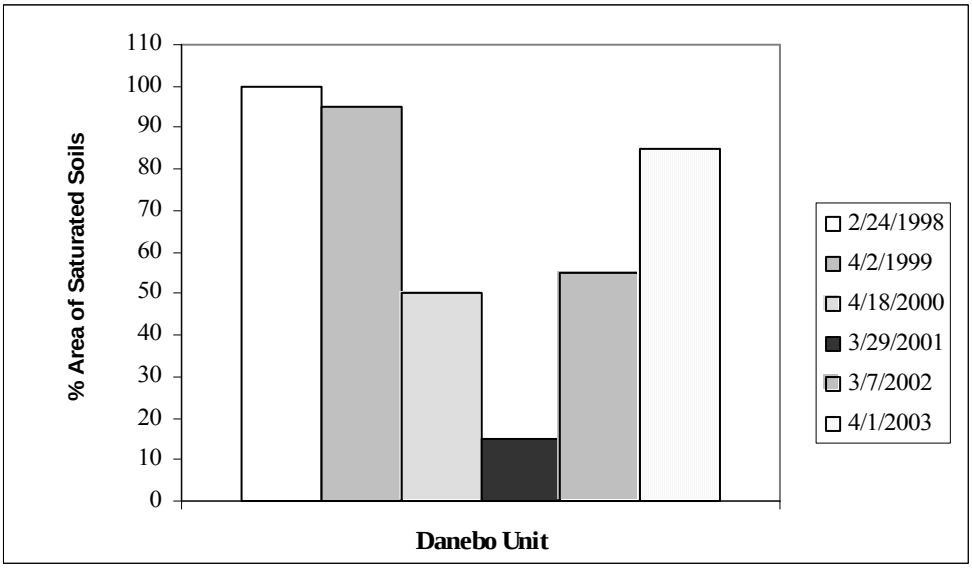


Figure 8.3. Spring saturated soils in the Danebo Unit. Percentage of the Danebo Unit with saturated soils in the early spring over the history of the restoration.

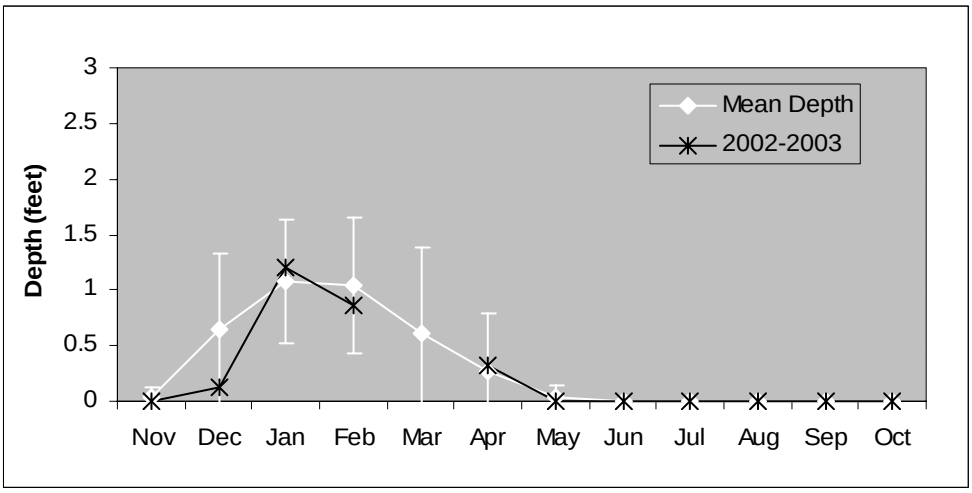


Figure 8.4. Danebo Unit inundation levels in the western section during 2002-2003 compared to the mean and standard deviation of depths between 1997 and 2003. Depth of inundation throughout the year in the western section during 2002 and 2003. The mean and standard deviation calculated from depths observed between 1997 and 2003 are also graphed for comparison.

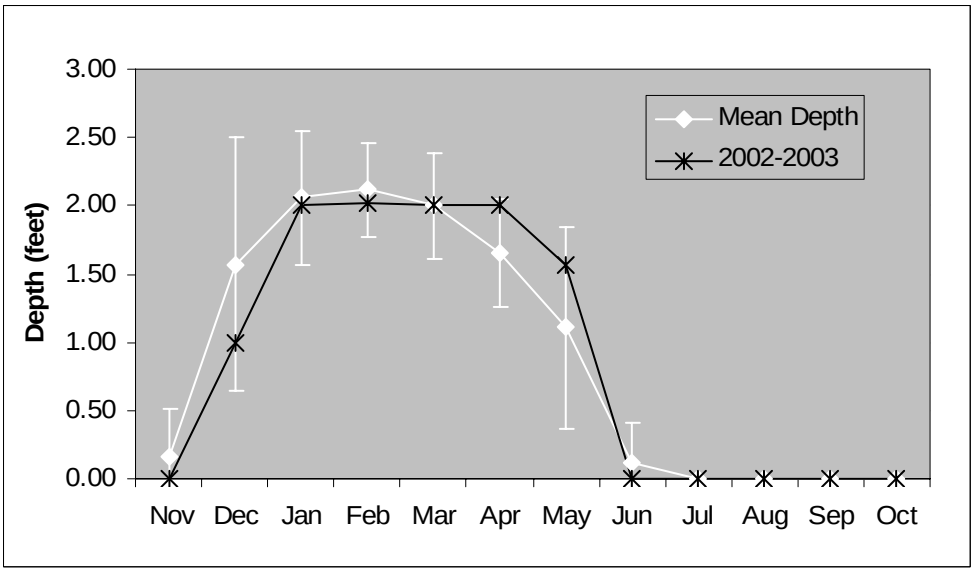


Figure 8.5. Danebo Unit inundation levels in the eastern section during 2002-2003 compared to the mean and standard deviation of depths between 1997 and 2003. Depth of inundation throughout the year in the eastern pool during 2002-2003. The mean and standard deviation calculated from depths observed between 1997 and 2003 are also graphed for comparison.

2. Vegetation

a) Methods

2002 represented the last year within the 7-year monitoring period for the Danebo restoration project. However, final evaluation of the site is occurring in the 2003 Annual Report because nested frequency data were collected in the 2003 field season.

Point-intercept data were collected July 3rd of 2002 from one macroplot, with a total of 240 points sampled. The analysis of these data is included in this year's report so that all data used to assess the site's vegetative success appear together in one report.

Nested frequency data were collected May 30th through June 4th of 2003. A total of 131 plots were sampled.

In addition, a species list was compiled for the entire site and can be viewed in Appendix B.

b) Results

Results of Point-intercept Cover Sampling:

Results of point-intercept monitoring indicate that native vegetative cover continues to dominate the site with 83% of the total cover in native species. This is an increase from 67% in 2001. The increased rainfall in 2002 may have contributed to the increase in three dominant species, *Deschampsia cespitosa*, *Navarretia intertexta*, and *Agrostis exarata*, from their 2001 levels. Additionally, a total of 36 species were detected by point intercept sampling, including 20 natives and 16 introduced species.

Despite the increase in native species cover, the proportion of introduced species on the site has continued to increase since the site's inception, from 15% cover in 1997 to 30% in 2002. However, the increase from 2001 to 2002 was not significant ($\alpha = .10$). Populations of *Leontodon nudicaulis*, *Hypochaeris radicata*, and *Agrostis alba*/*tenuis* contribute heavily to the cover of introduced species. The *Leontodon nudicaulis* population increased the most from 2001 to 2002, jumping from 2% to 6%.

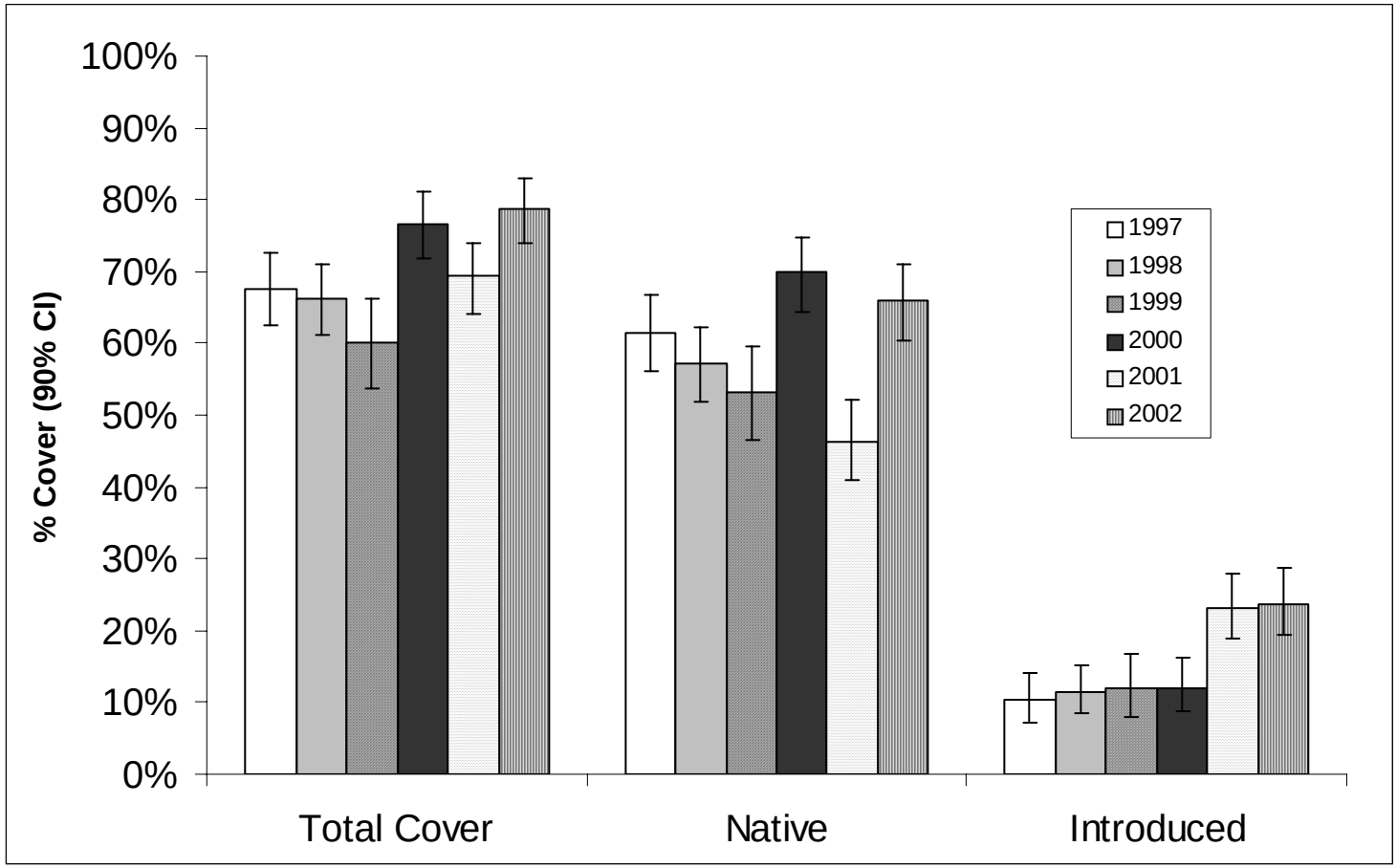


Figure 8.6. Percent cover of ground cover guilds at the Danebo Unit. Total percent cover, native percent cover and introduced percent covers are graphed through time for the Danebo Unit.

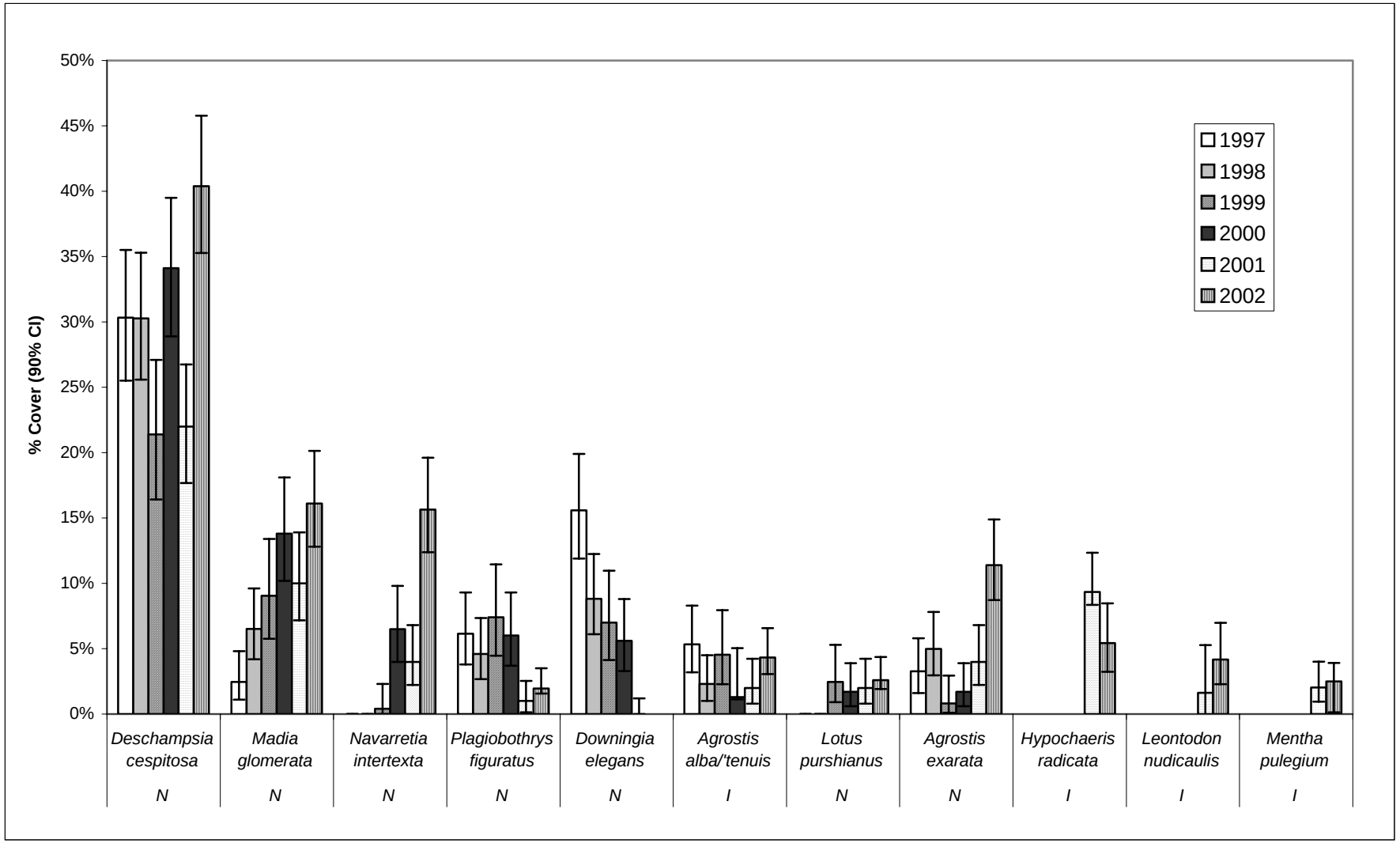


Figure 8.7. Native and introduced species in the Danebo Unit restoration with > 1% cover. All species in 2002 with greater than one percent cover are graphed over the history of the Danebo Unit restoration. Each species name is followed by either and 'N' or and 'I,' indicating whether the species is native or introduced.

Results of Nested Frequency Sampling:
A total of 114 species were detected during nested frequency data collections. Of those species observed, 59 were from the native plant list of West Eugene, 50 were not native, and 5 we could not identify to the species level. Table 8.3 lists the species observed with a frequency of greater than 10%. Habitat information is also provided for the native species. Of the native species occurring in the Danebo Restoration with a frequency of greater than 10%, 8 were wet prairie species and 9 were vernal pool or emergent species. Thus, the mitigation bank goal of 10 wet prairie species with greater than 10% frequency was not met, but the goal of 5 vernal pool species with greater than 10% frequency was met.

Table 8.3. Species Present with Greater than 10% Frequency in the Danebo Restoration. All species present with > 10% frequency in the Danebo Restoration are listed with their origin and 90% confidence limits. Habitat information is also listed for native species where 'VP/E' represents vernal pool and emergent habitats and 'WP' corresponds to wet prairie habitat.

Scientific Name	Origin	Frequency	Lower Limit	Upper Limit	Habitat
Deschampsia cespitosa	N	81.68	75.21	87.03	WP
Leontodon taraxacoides	I	57.25	49.69	64.56	
Plagiobothrys figuratus	N	55.73	48.16	63.09	VP/E
Madia sativa	N	49.62	42.11	57.14	WP
Mentha pulegium	I	49.62	42.11	57.14	
Agrostis exarata	N	41.22	33.97	48.77	WP & VP/E
Lotus unifoliolatus var. unifoliolatus	N	40.46	33.24	48.00	WP
Downingia spp.	N	39.69	21.12	34.62	VP/E
Navarretia intertexta ssp. intertexta	N	35.11	28.18	42.56	VP/E
Vicia tetrasperma	I	34.35	27.47	41.78	
Hypochaeris radicata	I	32.82	26.04	40.20	
Agrostis stolonifera/capillaris	I	30.53	23.92	37.82	
Centunculus minimus	unknown	30.53	23.92	37.82	
Eryngium petiolatum	N	29.01	22.52	36.23	VP/E
Gratiola ebracteata	N	29.01	22.52	36.23	VP/E
Juncus tenuis	N	29.01	22.52	36.23	WP
Alopecurus pratensis	I	26.72	20.43	33.82	
Parentucellia viscosa	I	25.19	19.04	32.20	
Microseris laciniata	N	24.43	18.36	31.39	WP
Hordeum brachyantherum	N	23.66	17.67	30.57	VP/E
Madia elegans	N	23.66	17.67	30.57	WP
Anthoxanthum odoratum	I	21.37	15.64	28.11	
Vicia sativa	I	18.32	12.97	24.79	
Daucus carota	I	16.79	11.65	23.10	
Prunella vulgaris var. lanceolata	N	16.79	11.65	23.10	WP
Aira caryophyllea var. capillaris	I	16.03	11.00	22.26	
Danthonia californica	N	16.03	11.00	22.26	WP
Juncus bufonius	N	15.27	10.35	21.41	VP/E
Myosotis discolor	I	15.27	10.35	21.41	
Galium sp.	?	14.50	9.71	20.55	
Grindelia integrifolia	N	14.50	9.71	20.55	WP & VP/E

Scientific Name	Origin	Frequency	Lower Limit	Upper Limit	Habitat
Centaurium erythraeae	I	13.74	9.07	19.69	
Moenchia erecta	I	12.98	8.44	18.83	
Leontodon taraxacoides	I	10.69	6.58	16.20	
Veronica peregrina var. xalapensis	N	10.69	6.58	16.20	VP/E

3. Wildlife Utilization

Wildlife use appeared similar to previous years (see previous Annual Reports 1998-2002). Great blue herons and mallards remain the most frequent visitors to the site.

Chapter 9: Isabelle Unit

A. Site Description

1. Size: 6.0 acres

2. Ownership: BLM

3. Site Timeline: **Table 9.1**

Section	Construction Years	Acreage	Monitoring Period
Enhancement	1997 & 1998	2.37	1999-2003
Restoration	1997 & 1998	1.60	1999-2003

4. Location

The Isabelle Unit is located at the eastern end of Isabelle Rd. It is bordered to the east by Beltline Road, to the south by the Danebo Unit and to the north by West Lawn cemetery.

5. Baseline Conditions

2.37 acres of the Unit remained as wetland prior to implementation of prescriptions in 1997. 1.60 acres of the historic wetland were filled during the development of Isabelle Street. Prior to development of the industrial park, the site was utilized for agricultural purposes

6. Focus of Prescriptions

To restore, enhance and create wet prairie. Prescriptions focused on extraction and removal of fill material. Excavation restored the grade to the original hydric soil. Non-native woody vegetation was cleared from the existing wet prairie, exposed soils were seeded with native prairie grasses and forbs, and the perimeter of the restoration area was seeded with a native upland prairie mix and will be planted with native oak and ash. This perimeter planting will functionally as a buffer from the adjacent industrial park to the west and from Beltline Rd to the east.

7. Site-Specific Management Goals

1. Remove fill (previously placed in wetlands) down to the original hydric soil surface.
2. Re-establish the wet prairie community in areas where fill is removed.
3. Enhance the existing wet prairie community by removing invasive non-native and woody vegetation.
4. Utilize the southwestern portion of the site for a camas salvage experiment. Fill was first removed from the area. Native hydric soil with camas bulbs was removed from a development site was then spread over this area.

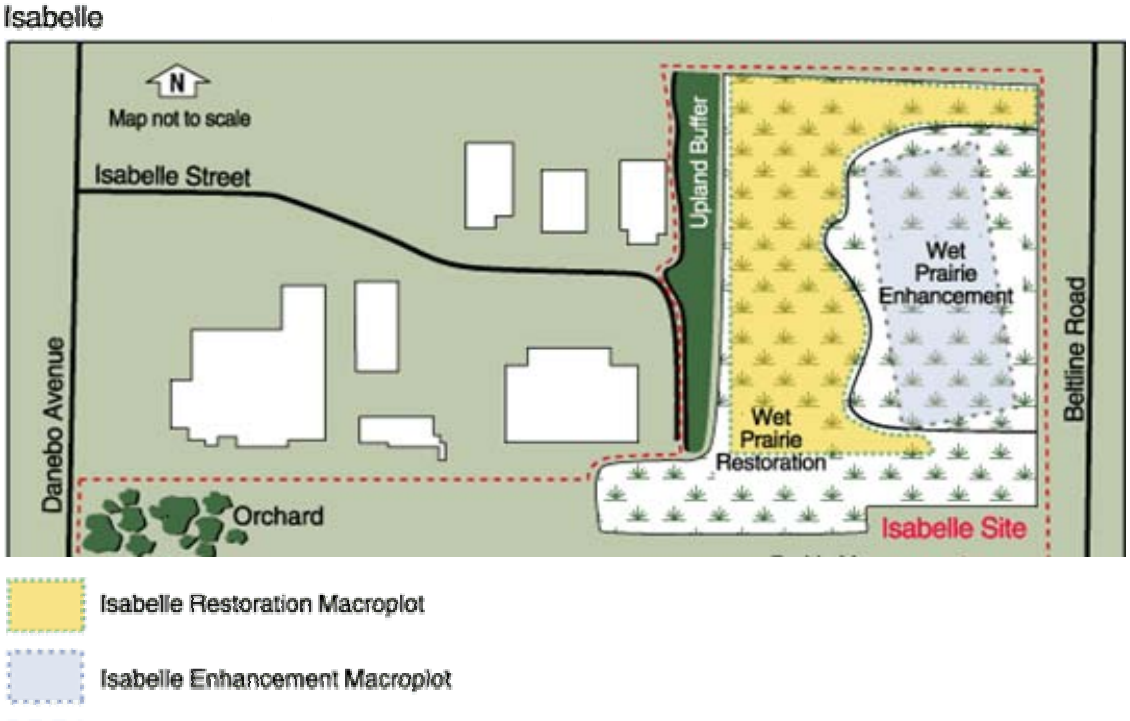


Figure 9.1. Isabelle Site Map. The map shows the Enhancement and Restoration areas labeled with their associated macroplots.

B. 2003 Monitoring Summary

Both the enhancement and restoration areas have sufficient hydrology to support the development of hydric soils and native hydrophytic vegetation. The hydrology of the enhancement area supports a diverse wet prairie community, while the restoration contains a mix of vernal pool and wet prairie habitat.

The enhancement area met all mitigation bank success criteria for woody vegetation reduction. Additionally, it appears that the removal of woody vegetation, along with yearly mowing to prevent regrowth, resulted in a significant increase ($\alpha = 0.10$) in the percent cover of native vegetation (from 42% to 69%).

The restoration area met 3 of the 5 fifth year mitigation standards. The 3 standards the site was successful in meeting require that 70% of the species planted be present in the final year, that 10 wet prairie species have a frequency of 10% or greater, and that 5 vernal pool species have a frequency of 10% or greater. The standards also require that the site have 70% native cover after 5 years—the Isabelle restoration has 67% native cover. The last standard states that 75% of species occurring at a frequency of 50% or greater be native. Only 6 species had a frequency of 50% or greater and 4 of these were native (66%). However, 75% of the species with a frequency of *20%* or greater were native.

1. 2003 Management Actions

Restoration:

A maintenance crew spent one day hand pulling exotics.

Enhancement specific actions:

The entire enhancement area was mowed in late fall to suppress woody vegetation growth.

2. Management Actions for 2004

The BLM will continue mowing in late fall to suppress woody vegetation removal.

Table 9.2. Progress of the Isabelle Unit restorations towards meeting the MOA vegetation standards. The most recent data for each section are compared to their relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Restoration	Goal Met?
Site status in the monitoring period	Year 5 of 5	N/A
Most recent quantitative data collected in year:	PI & NF- 2003	N/A
50% native **cover** after 2 years	82%	Yes
70% native **cover** after 5 years	67%	No
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	4 of 6 = 66%	No
70% of the planted species shall be alive and present at the end of the five year monitoring period	70%	Yes
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	17	Yes
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	9	Yes

Table 9.3. Progress of the Isabelle Unit Enhancement towards meeting the MIP vegetation standards. The most recent data for the enhancement are compared to their relevant vegetation standards from the MIP. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'LI' refers to point-intercept cover data collection.

Site Characteristics and MIP Vegetation Standards	Enhancement Area	Goal Met?
Site status in the monitoring period	Year 5 of 5	N/A
Most recent quantitative data collected in:	2003	N/A
60% reduction of total shrub cover after 5 years	77% reduction	Yes
70% reduction of tree density after 5 years	97%	Yes

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during site visits in early spring. Water depths were measured periodically at 1 staff gauge.

b) Results

The hydrology at Isabelle remains fairly constant, fluctuating only with changes in the amount of precipitation received from year to year. The restoration area always holds considerably more water, with large pools up to 6 inches deep, than the enhancement area, which has mostly saturated soils. However, both the restoration and the enhancement area contain enough water, in duration and timing, to support the development of hydric soils and hydrophytic vegetation (Figure 9.2-9.4).

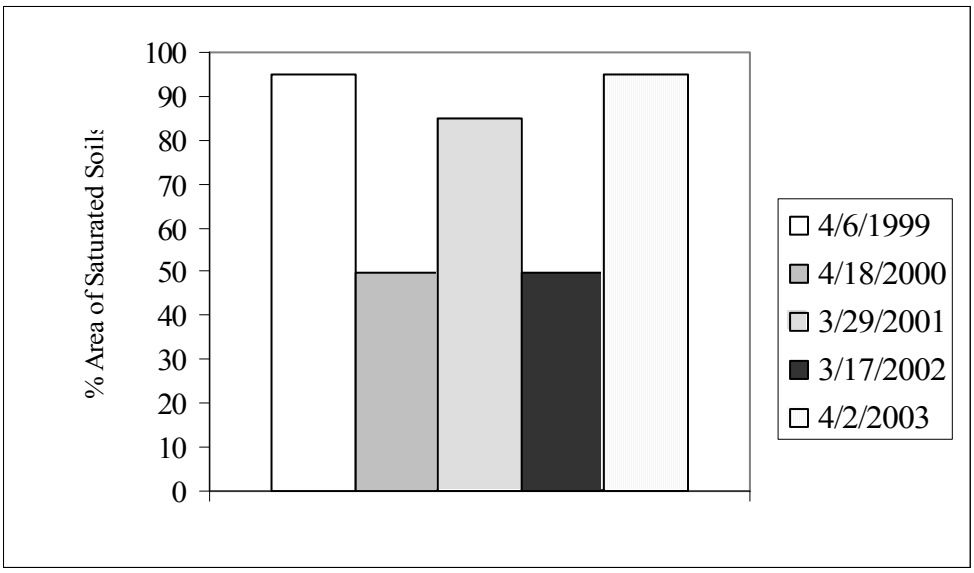


Figure 9.2. Spring standing water in the Isabelle Unit. Percentage of the Isabelle Unit with standing water in the early spring over the history of the restoration.

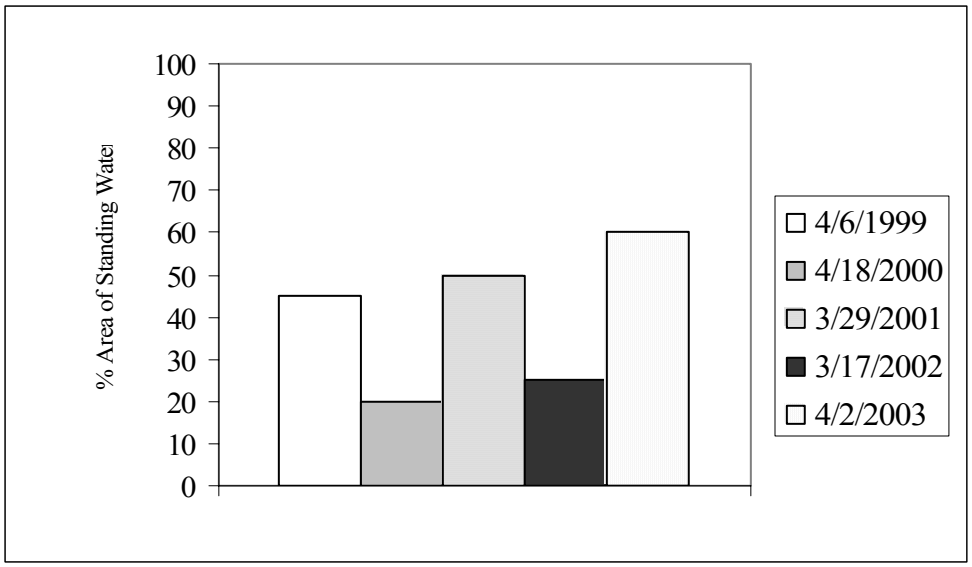


Figure 9.3. Spring saturated soils in the Isabelle Unit. Percentage of the Isabelle Unit with saturated soils in the early spring over the history of the restoration.

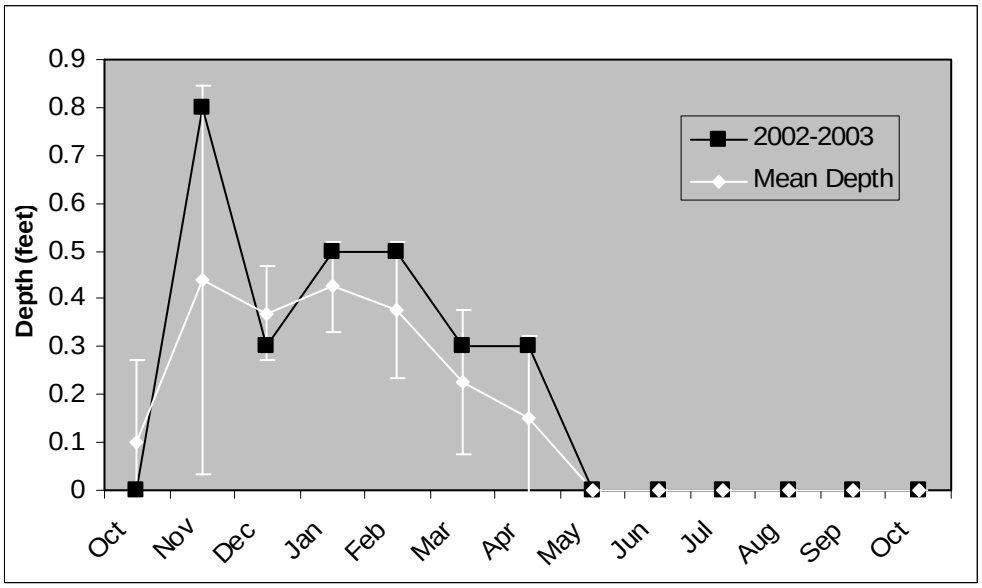


Figure 9.4. Isabelle Restoration inundation levels in the southwestern section during 2002-2003 compared to the mean and standard deviation of depths between 1999 and 2003. Depth of inundation throughout the year in 2002-2003. The mean and standard deviation calculated from depths observed between 1999 and 2003 are also graphed.

2. Vegetation

a) Restoration Methods

2003 represented the last year within the 7-year monitoring period for the Isabelle restoration project.

Point-intercept data were collected July 15th, 18th, 21st, and 22nd of 2003 from one macroplot, with a total of 300 points sampled. These data are compared to data collected the second year following restoration (2000).

Nested frequency data were collected July 15th, 18th, 21st, 22nd, and 23rd of 2003 from the same macroplot, with a total of 108 plots sampled.

In addition, a species list was compiled for the entire site and can be viewed in Appendix B.

b) Restoration Results

Results of Point-intercept Cover Sampling:

There were several significant changes ($\alpha = .10$) in the percent cover of individual species as well as cover classes between 2000 and 2003 (Figures 9.5 and 9.6). The amount of bare ground on the site decreased significantly (from 43.7% to 23.7%), with corresponding significant increases in litter (8.7% to 24%) and moss (0% to 7.3%). *Deschampsia cespitosa* decreased significantly from 18.4 to 7.7. Despite these changes, 67% ($62.3 \leq x \leq 71.5$) of the total cover was native. This is very close to the 70% native cover standard for the mitigation bank. Additionally, there were four native species that increased to above 1% cover between 2000 and 2003.

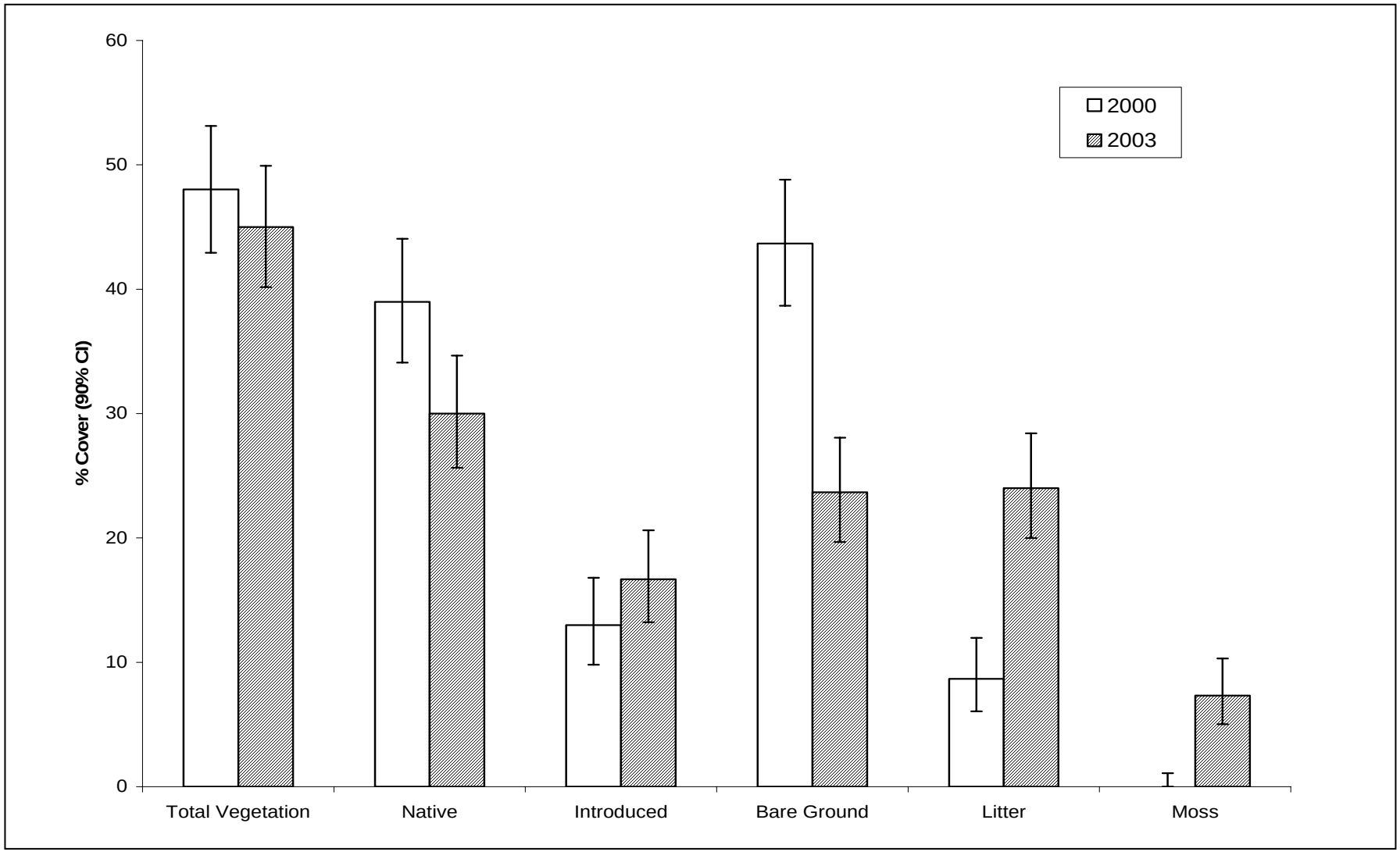


Figure 9.5 Percent cover of ground cover guilds at the Isabelle Unit Restoration. Total percent cover, native percent cover and introduced percent covers are graphed through time for the Isabelle Unit.

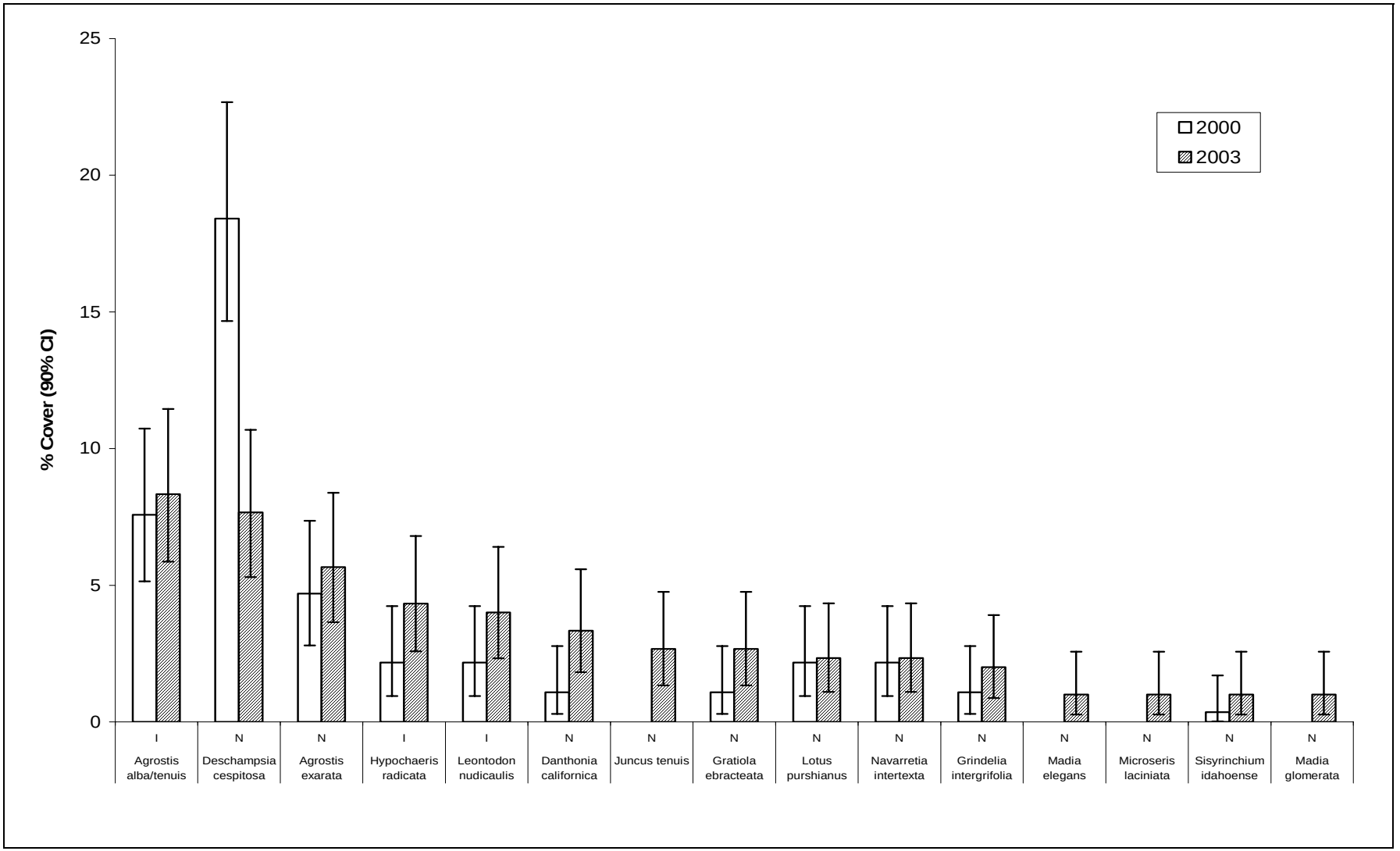


Figure 9.6. Native and introduced species in the Isabelle Unit restoration with > 1% cover. All species in 2003 with greater than one percent cover are graphed over the history of the Isabelle Unit restoration. Each species name is followed by either and 'N' or and 'I,' indicating whether the species is native or introduced.

c) Results of Nested Frequency Sampling:

A total of 74 species were detected while sampling using nested frequency methods. Of these 74 species, 46 were native, 24 non-native, and 4 could not be identified to the species level to determine nativity. Nested frequency data are used to determine the success of the site according to 3 vegetation standards. The first, that 75% of the species with a frequency of 50% or great should be native, was not met by the restoration at Isabelle. Instead, 66% of the species with a frequency of 50% or greater were native. However, 75% of the species with a frequency of 20% or greater were native. The second and third goals, that 10 of the species with a frequency of 10% or greater should be wet prairie species and that 5 should be vernal pool or emergent species, were met by the restoration at Isabelle. Seventeen species with a frequency of 10% or great were wet prairie and 9 were vernal pool or emergent species.

Table 9.4. Species Present with Greater than 10% Frequency in the Isabelle Restoration. All species present with > 10% frequency in the Isabelle Restoration are listed with their origin and 90% confidence limits. Habitat information is also listed for native species where 'VP/E' represents vernal pool and emergent habitats and 'WP' corresponds to wet prairie habitat.

Scientific Name	Origin	Frequency	Lower Limit	Upper Limit	Habitat
Deschampsia cespitosa	N	88.39	83.27	92.36	WP
Agrostis stolonifera/capillaris	I	67.10	60.36	73.34	
Lotus unifoliolatus var. unifoliolatus	N	62.58	55.72	69.07	WP
Agrostis exarata	N	53.55	46.63	60.37	WP & VP/E
Hypochaeris radicata	I	53.55	46.63	60.37	
Madia glomerata	N	52.26	45.35	59.10	WP
Leontodon taraxacoides	I	47.10	40.27	54.01	
Danthonia californica	N	44.52	37.75	51.44	WP
Grindelia integrifolia	N	41.94	35.25	48.85	WP & VP/E
Downingia spp.	N	38.00	30.10	47.11	VP/E
Navarretia intertexta ssp. intertexta	N	37.42	30.93	44.28	VP/E
Juncus bufonius	N	35.48	29.09	42.30	VP/E
Aira caryophyllea var. capillaris	I	33.55	27.27	40.31	
Juncus tenuis	N	31.61	25.45	38.31	WP
Gratiola ebracteata	N	30.97	24.85	37.64	VP/E
Microseris laciniata	N	27.74	21.86	34.27	WP
Anthoxanthum odoratum	I	24.52	18.92	30.86	
Panicum acuminatum ssp. fasciculatum	N	24.52	18.92	30.86	WP
Eryngium petiolatum	N	23.87	18.33	30.18	VP/E
Prunella vulgaris var. lanceolata	N	20.65	15.43	26.72	WP
Madia sativa	N	14.84	10.36	20.36	WP
Brisa minor	I	14.19	9.81	19.64	
Centaurium muhlenbergii	N	12.90	8.72	18.20	WP
Cicendia quadrangularis	N	11.61	7.64	16.73	VP/E
Fraxinus latifolia	N	10.97	7.11	16.00	WP
Epilobium densiflora	N	10.32	6.58	15.26	WP
Sisyrinchium idahoense var.	N	10.32	6.58	15.26	WP

Scientific Name	Origin	Frequency	Lower Limit	Upper Limit	Habitat
idahoense					
Aster hallii	N	7.74	4.53	12.24	WP
Carex densa	N	1.29	0.23	4.01	WP
Carex obnupta	N	1.29	0.23	4.01	VP/E
Carex ovalis	I	1.29	0.23	4.01	

Results of Species Lists Analysis:
Of the 50 species planted on the Isabelle Restoration, 35 are present on the site (70%). This meets the mitigation bank standard that 70% of the species planted be present on the site 5 years after restoration.

c) Enhancement Methods
Point-intercept data were collected July 23rd and 24th of 2003 from one macroplot, with a total of 203 points sampled. These data are compared to pre-treatment data collected in 1998 (before the woody vegetation clearing).

Line-intercept data were collected from 20 transects on August 12th and 13th. These data are compared to the baseline data collected in 1997 (prior to woody vegetation removal) and to data collected in 2001 (two years after woody vegetation removal).

A census of all the trees in the Enhancement was taken on August 12th and 13th. These data are also compared to pre-treatment data collected in 1997.

In addition, a species list was compiled for the entire site and can be viewed in Appendix B.

d) Enhancement Results
Results of Point-intercept Cover Sampling:
There are no mitigation bank standards for percent cover for enhancement projects. These data were collected by the bank to track the effect of woody vegetation on the cover of native and non-native vegetation (Figures 9.7 and 9.8). After the initial treatment, the site was mowed nearly every other year. The total vegetative cover increase significantly ($\alpha = 0.10$) from 73% to 89% and the total native vegetation increase significantly from 42% to 69%. Correspondingly, the percent of non-native species, bare ground, litter, and moss all decreased. Of the native species with greater than 1% cover, 8 increased significantly, with *Danthonia califonica* showing the greatest increase.

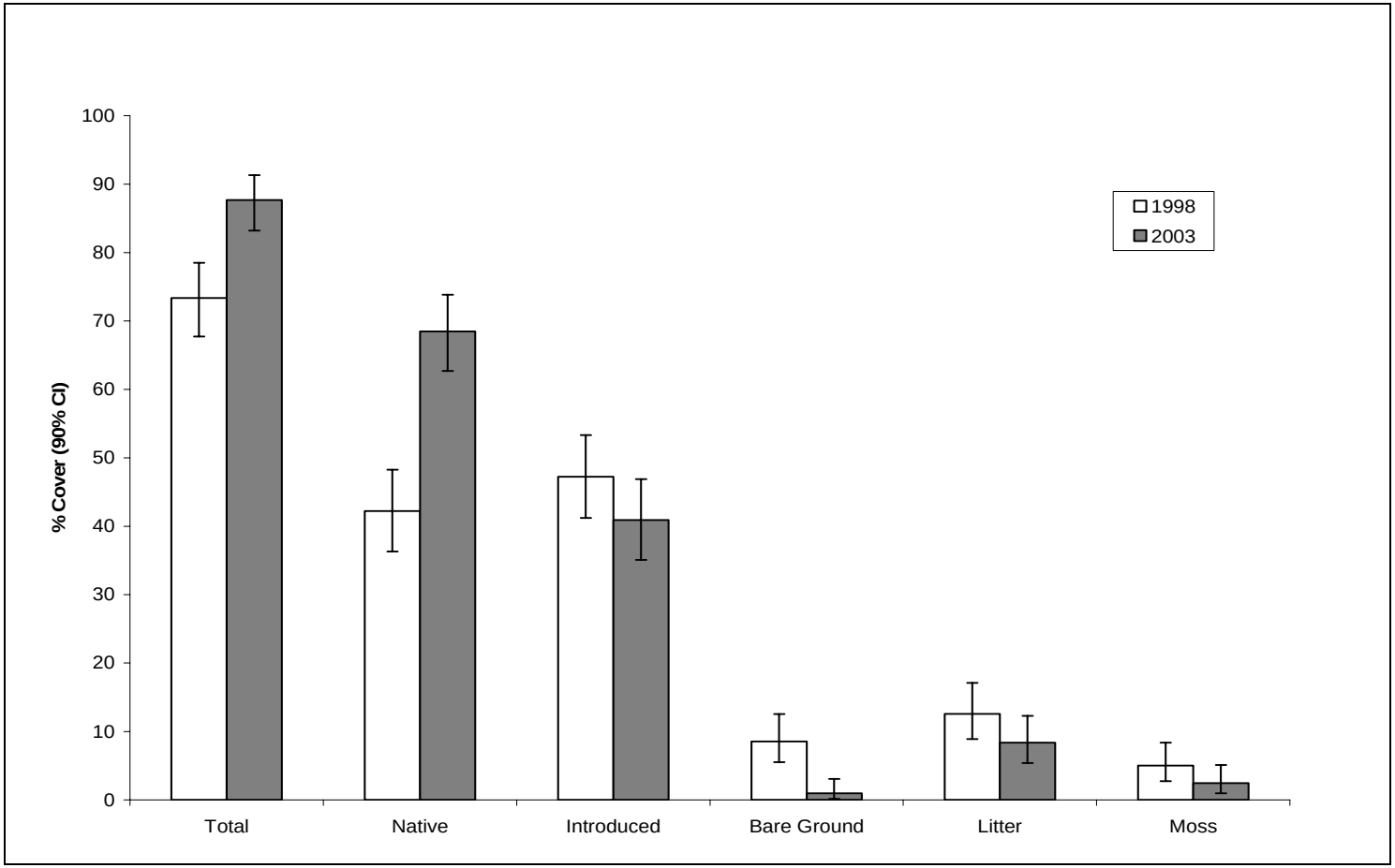


Figure 9.7. Percent cover of ground cover guilds at the Isabelle Unit Enhancement. Total percent cover, native percent cover and introduced percent covers are graphed through time for the Isabelle Unit.

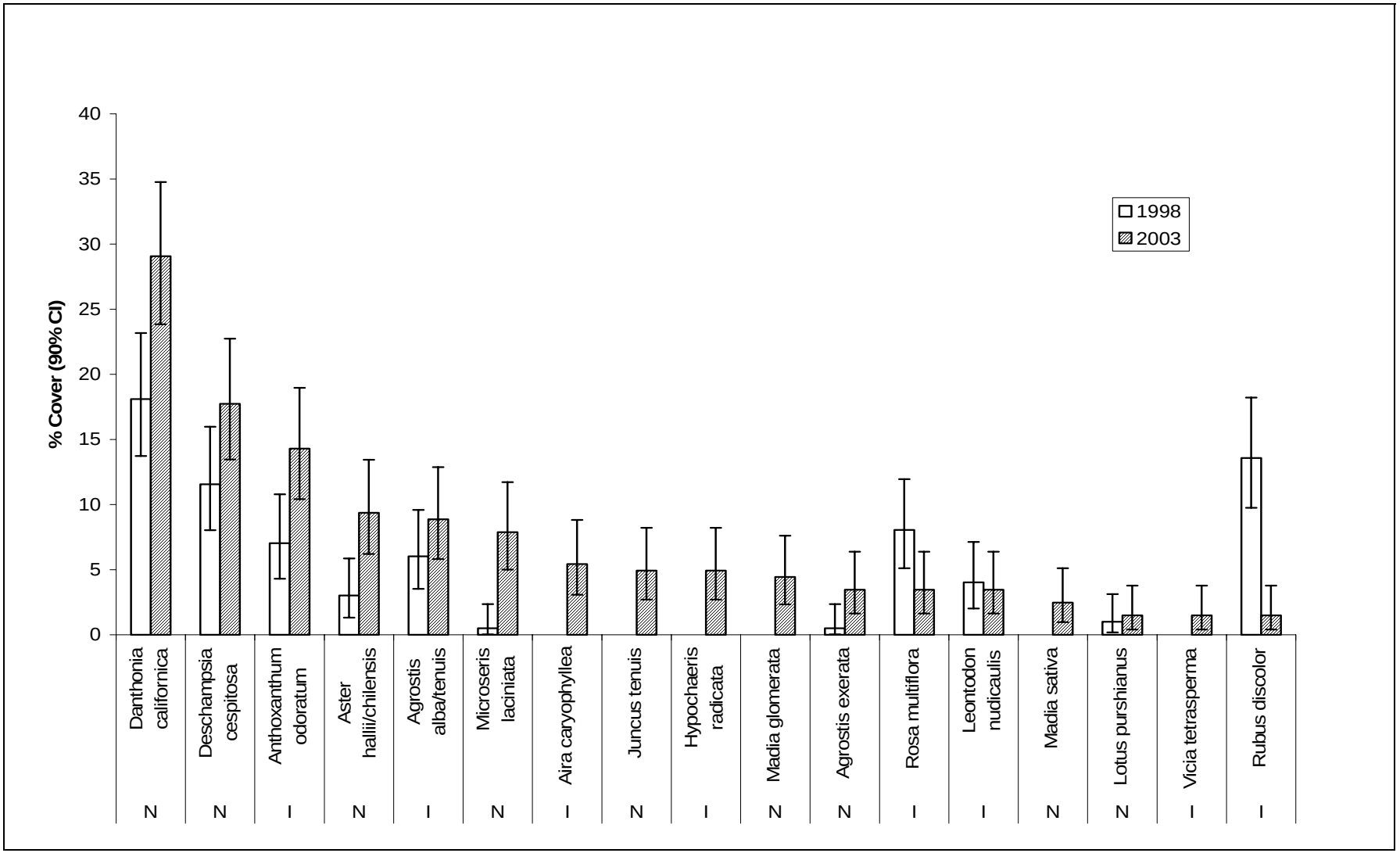


Figure 9.8. Native and introduced species in the Isabelle Unit enhancement with > 1% cover. All species in 2002 with greater than one percent cover are graphed over the history of the Enhancement Unit restoration. Each species name is followed by either and 'N' or and 'I,' indicating whether the species is native or introduced.

Results of Line-intercept Sampling:

Isabelle Enhancement met the mitigation bank requirement that the total shrub cover be reduced by 60% 5 years after the initial treatment of woody vegetation removal. The total shrub cover was decreased by 77%.

Table 9.5. Percent Cover of Shrub in the Isabelle Enhancement in 1997, 2001, and 2003. The table includes all shrub species found in the Isabelle Enhancement in 1997 (prior to woody vegetation removal), 2001 (3 years post treatment), and 2003 (5 years post treatment). The percent cover of each species in each year, with a 90% confidence interval, is also listed. Below the species level information, the total shrub percent cover, total native shrub percent cover, and total non-native shrub percent cover are included with 90% confidence intervals.

N/I	Species	1997 Mean	1997 90% CI	2001 Mean	2001 90% CI	2003 Mean	2003 90% CI
N	*Amelanchier alnifolia*	0.11%	±0.07%	0.02%	±0.02%	0.04%	±0.04%
N	*Cytisus scoparius*	0.06%	±0.07%	0.15%	±0.14%	0.04%	±0.06%
I	*Rosa eglanteria*	0.11%	±0.09%	0.03%	±0.04%	0.02%	±0.02%
I	*Rosa multiflora*	15.94%	±4.62%	7.61%	±1.65%	5.67%	±1.80%
N	*Rosa nutkana*	1.44%	±1.16%	1.17%	±0.76%	1.26%	±0.84%
N	*Rosa pisocarpa*	0.00%	±0.00%	0.84%	±1.00%	0.00%	±0.00%
I	*Rubus armeniacus*	19.84%	±5.12%	7.70%	±1.79%	1.47%	±0.52%
I	*Rubus laciniatus*	0.17%	±0.17%	0.08%	±0.08%	0.02%	±0.02%
N	*Toxicodendron diversiloba*	0.11%	±0.11%	0.01%	±0.01%	0.17%	±0.15%
	Total	**37.78%**	±6.68%	**17.61%**	±2.83%	**8.41%**	±2.35%
	Native	**1.66%**	±1.27%	**9.80%**	±2.22%	**1.31%**	±0.80%
	Introduced	**36.12%**	±6.58%	**7.81%**	±1.64%	**7.10%**	±2.08%

Results of Tree Census:
The mitigation bank standard for tree reduction is that 70% of trees that are greater than 1 m tall should be removed. The results of the tree census show a 97% reduction of the trees greater than 1 m tall.

Table 9.6. Tree Census Results from the Isabelle Enhancement in 1997, 2001, and 2003. The table includes all tree species found in the Isabelle Enhancement in 1997 (prior to woody vegetation removal), 2003, whether the trees are native or non-native in origin, totals by height class and species, and the percent reduction in trees.

N/I	Species	Number of trees by height class								Species total	
		1-2 m		2-3 m		3-4 m		>4 m			
		1997	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**
N	Crataegus douglasii	293	0	105	0	44	0	16	0	458	0
I	Crataegus hybrid	0	4	0	1	0	0	0	0	0	5
I	Crataegus monogyna	4	0	1	0	1	0	0	0	6	0
N	Fraxinus latifolia	24	9	3	1	2	0	11	0	40	10
I	Prunus avium	0	0	2	0	0	0	0	0	2	0
I	Pyrus communis	2	0	0	0	0	0	1	0	3	0
N	Pyrus fusca	6	0	7	0	0	0	1	0	14	0
N	Rhamnus purshiana	0	0	1	0	0	0	0	0	1	0
Totals by height class		329	13	119	2	47	0	29	0	**524**	**15**

Difference between 1998 and 2003 in the total number of tree between = 509
Percent reduction = 97%

3. Wildlife Utilization
Sightings were consistent with previous use (See previous Annual Reports). As has been previously noted, wildlife use of the site appears limited, possibly due to its relatively small size and proximity to heavily used roads and adjacent development. In addition, the nearby Amazon Creek channel and riparian zone probably attract many wildlife species away from this site. Despite these limitations, a kestrel (*Falco sparverius*) has been observed hunting on this site.

Chapter 10: Nolan Unit

A. Site Description

1. Size: 16.32 acres

2. Ownership: City of Eugene

3. Site Timeline: **Table 10.1**

Section	Construction Year	Monitoring Period
East	1997	1998-2005*
West	1997	1998-2005*

*Monitoring period has been extended to allow for remedial action.

4. Location

Former site of the partially developed Nolan Industrial Park, the Unit is situated along the north bank of Amazon Creek, east of Beltline Road, and south of 7th Street.

5. Site History

The site was farmed through the late 1970's. In 1980, urban infrastructure was extended to the site. The site was to be developed as an industrial park.

6. Focus of Prescriptions

Restoration and enhancement of wetland prairie and emergent wetland communities. Restoration and enhancement of the wetland was realized through the excavation and removal of fill material, grading and scarifying hydric soils and the installation of water control structures to regulate site hydrology. The site was seeded with native plant species.

7. Site-Specific Management Goals

1. Preserve, enhance, and restore wetlands adjacent to Amazon Creek.
2. Remove fill (previously placed in wetlands) down to the original hydric soil surface, and restore with native emergent wetland vegetation.
3. Enhance existing wetlands by eliminating reed canarygrass from the site.

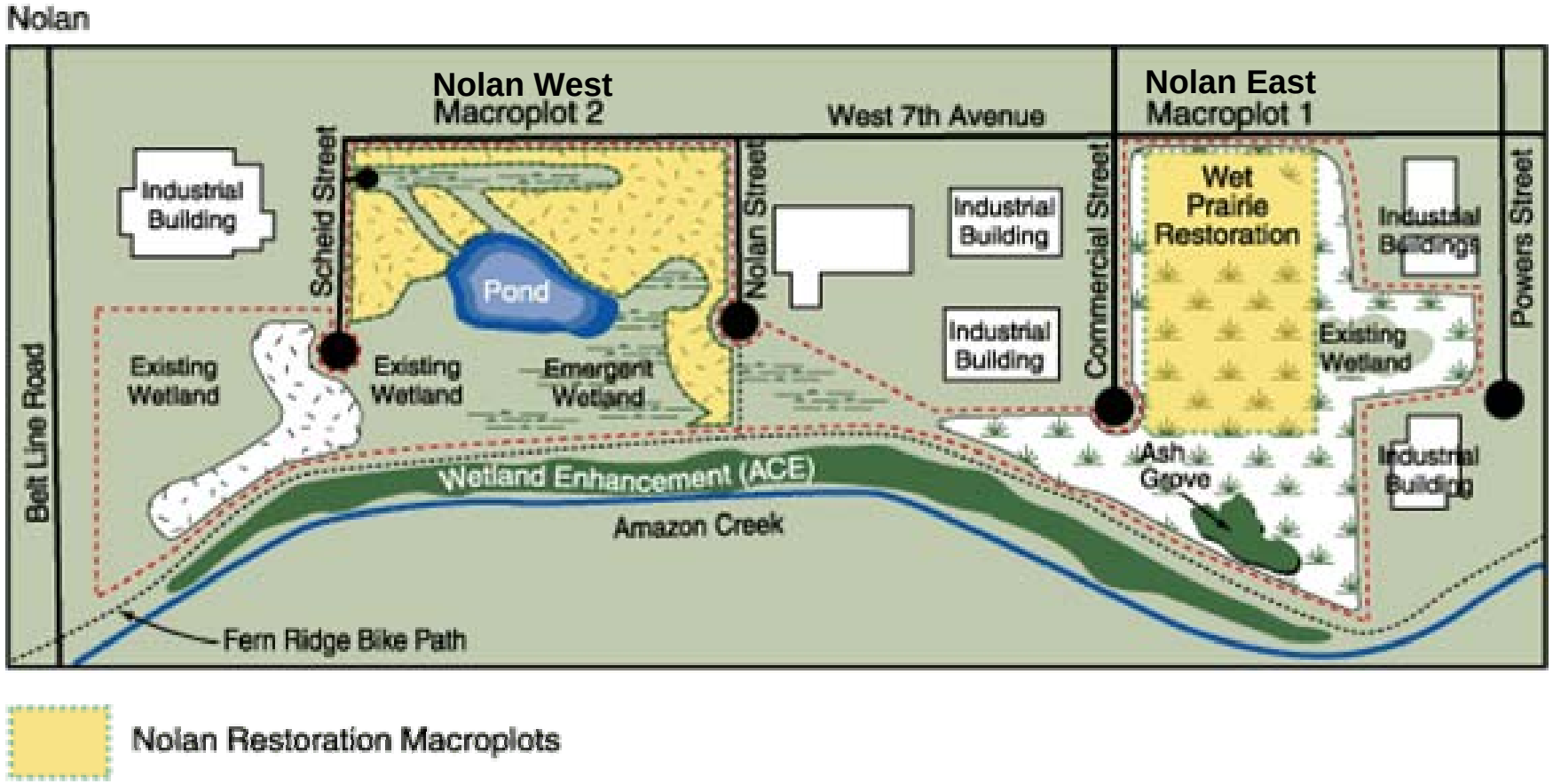


Figure 10.1. Nolan Unit Site Map. Nolan East and Nolan West restorations are labeled with their associated macroplots.

B. 2003 Monitoring Summary

This year was the 6th of the 7-year monitoring period for the Nolan Unit. Both the eastern and western sections continue to demonstrate wetland hydrology sufficient to support the development of wetland soils and vegetation. Pennyroyal continues to persist on the mitigation over large areas, despite many attempts to remove it. Nolan East was sprayed and then tilled in 2002, and while it set the pennyroyal back, it was still present and will likely return to pre-spray levels in 2004. Remedial actions will likely be necessary to control its spread on both the eastern and western sections of Nolan.

1. 2003 Management Actions

Nolan East:

1. Reed canarygrass and Harding grass were mowed in the early spring and fall to prevent flowering.
2. Maintenance crews spent one day hand weeding the site.

Nolan West:

1. Patches of reed canarygrass and Harding grass were mowed or the seed heads were cut over the whole site.
2. Maintenance crews also spent one day hand weeding the site.
3. The perimeter was mowed.

2. Management Actions for 2004

1. Continue early fall perimeter mow around entire site.
2. Remove teasel (*Dipsacus fullonum*) along bike path edge.
3. Focus on controlling reed canary-grass (*Phalaris arundinacea*) and Harding grass (*Phalaris aquatica*) to prevent its spread.
4. Remove female ash trees from the grove in southern portion of east Nolan to keep the expansion of the ash grove from moving into the prairie via seed. Girdle the larger female ash trees, but maintain on site for habitat.
5. Continue to remove ash and hawthorn by hand as they spread into prairie.
6. Create a plan to remove the large monocultural patches of pennyroyal from the restorations.
7. Plant Douglas spiraea, Nootka rose, and willows in the vernal pool areas.

Table 10.2. Progress of the Nolan Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Nolan East	Goal Met?	Nolan West	Goal Met?
Site status in the monitoring period	Year 6 of 7	N/A	Year 6 of 7	N/A
Most recent quantitative data collected in:	PI - 2002	N/A	PI - 2002	N/A
70% native cover after 5 years	63.4%	No	78.7%	Yes
75% of those species occurring at a 50% frequency rate or grater shall be from the Native Plant list	2004	TBD	2004	TBD
70% of the planted species shall be alive and present at the end of the seven year monitoring period	2004	TBD	2004	2004
Wet Prairie: minimum of 10 native species occurring at 10% frequency rate or greater	2004	TBD	2004	2004
Emergent: minimum of 5 native species occurring at 10% frequency rate or greater	2004	TBD	2004	2004

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits, the first in early spring and the second in late fall. Water depths were measured monthly at 1 staff gauge.

b) Results

Both Nolan East and Nolan West have hydrology sufficient for the development of hydric soils and hydrophytic vegetation (Figures 10.2-10.4). Neither section of Nolan showed any changes in hydrology.

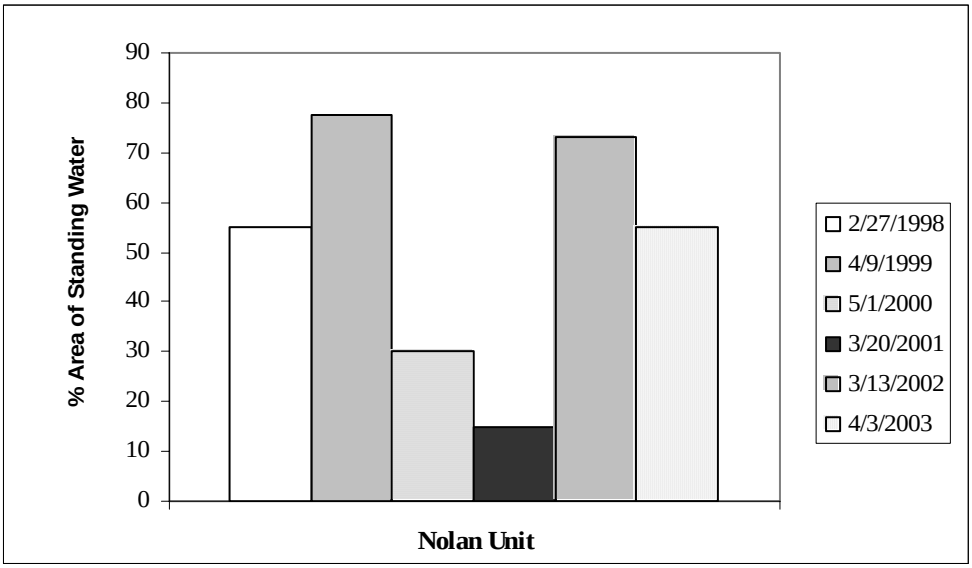


Figure 10.2. Spring standing water in the Nolan Unit. Percentage of the Nolan Unit with standing water in the early spring over the history of the restoration.

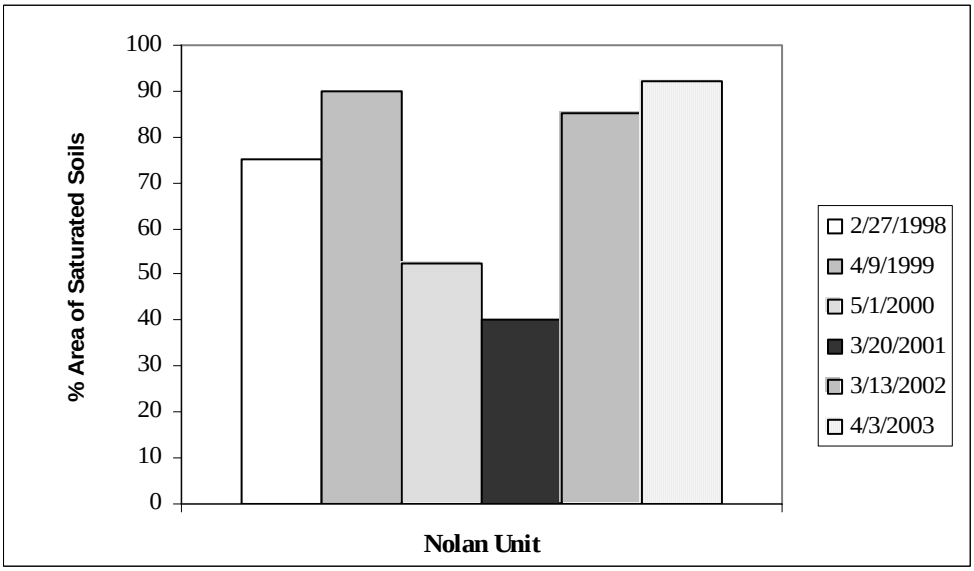


Figure 10.3. Spring saturated soils in the Nolan Unit. Percentage of the Nolan Unit with saturated soils in the early spring over the history of the restoration.

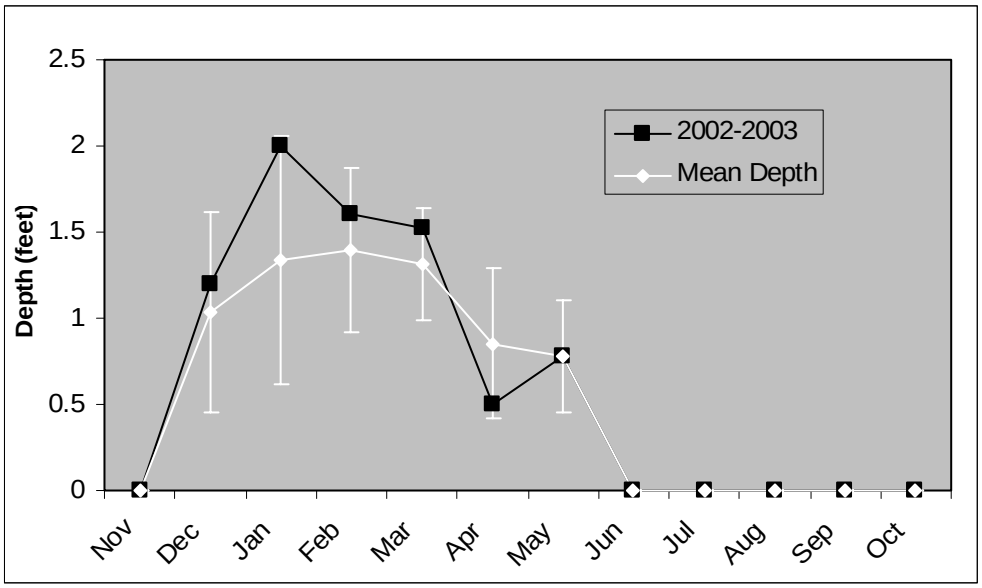


Figure 10.4. Nolan Unit inundation levels in the western section during 2002-2003 compared to the mean and standard deviation of depths between 1998 and 2003. Depth of inundation throughout the year in the eastern in 2002-2003. The mean and standard deviation calculated from depths observed between 1998 and 2003 are also graphed for comparison.

2. Vegetation

a) Methods

No quantitative monitoring was scheduled this year on any section of the Nolan Unit. Routine qualitative monitoring, such as weed mapping and photopoints, were completed. Point-intercept and nested frequency for the entire site are scheduled for the summer of 2004. Species lists were updated for each section and the results can be viewed in Appendix B.

3. Wildlife Utilization

Waterfowl are attracted by the seasonal pond and remain the most frequent visitors to the site. Specific sightings for this year include Canada geese, mallards, and ring-necked pheasants.

Chapter 11: North Greenhill Prairie

A. Site Description

1. Size: 71 acres

2. Ownership: BLM

3. Site Timeline: **Table 11.1**

Section	Construction Year/s	Acreage	Monitoring Period
Phase 1 Sod-Removal	1998	12.5 acres	1999-2003
Phase 1 Solarization	1998	1.0 acres	1999-2003
Phase 2 Sod-Removal	2000-2002	7.5 acres	2000-2005
Phase 2 Solarization	2000	0.9 acres	2001-2004
Phase 3 Sod-Removal	2002	19.04 acres	2003-2007

4. Location

The site is located on the west side of Greenhill Road, approximately one half mile south of Royal Avenue and approximately three quarters of a mile north of the Southern Pacific Railroad tracks in Township 17 S., Range 4 W., Section 30, tax lot 2100.

5. Site History

Of the 71 acres, 50.6 acres were delineated as farmed wetland. Sampling indicated that approximately 90% of the vegetation was non-native grasses. From conditions observed in February and March of 1997, it was determined that there were three primary sources of water on the site: precipitation directly on the site, flow from the South Greenhill site, and flow from seeps likely fed by run-off from the east side of Oak Hill. The site was farmed for hay production prior to BLM ownership.

6. Focus of Prescriptions

Restore/enhance native wet prairie and vernal pool communities in the former agricultural lands on the site.

7. Site-Specific Management Goals

1. Restore natural hydrology by dispersing water flows currently confined to ditches into broader surface flows.
2. Restore/enhance native wet prairie and vernal pool communities in the agricultural lands on the site.
3. Restore upland prairie vegetation to the tops of mounds situated within the wetland mitigation area.
4. Enhance habitat conditions for native wildlife species associated with wet prairie and ash savanna habitats.
5. Ensure compatibility of wetlands between this mitigation site and the ODOT mitigation site immediately to the south.
6. Take advantage of the large size of the site to establish large areas of contiguous wetland communities on the site and in conjunction with future wetland restoration on adjacent sites to the east and south.

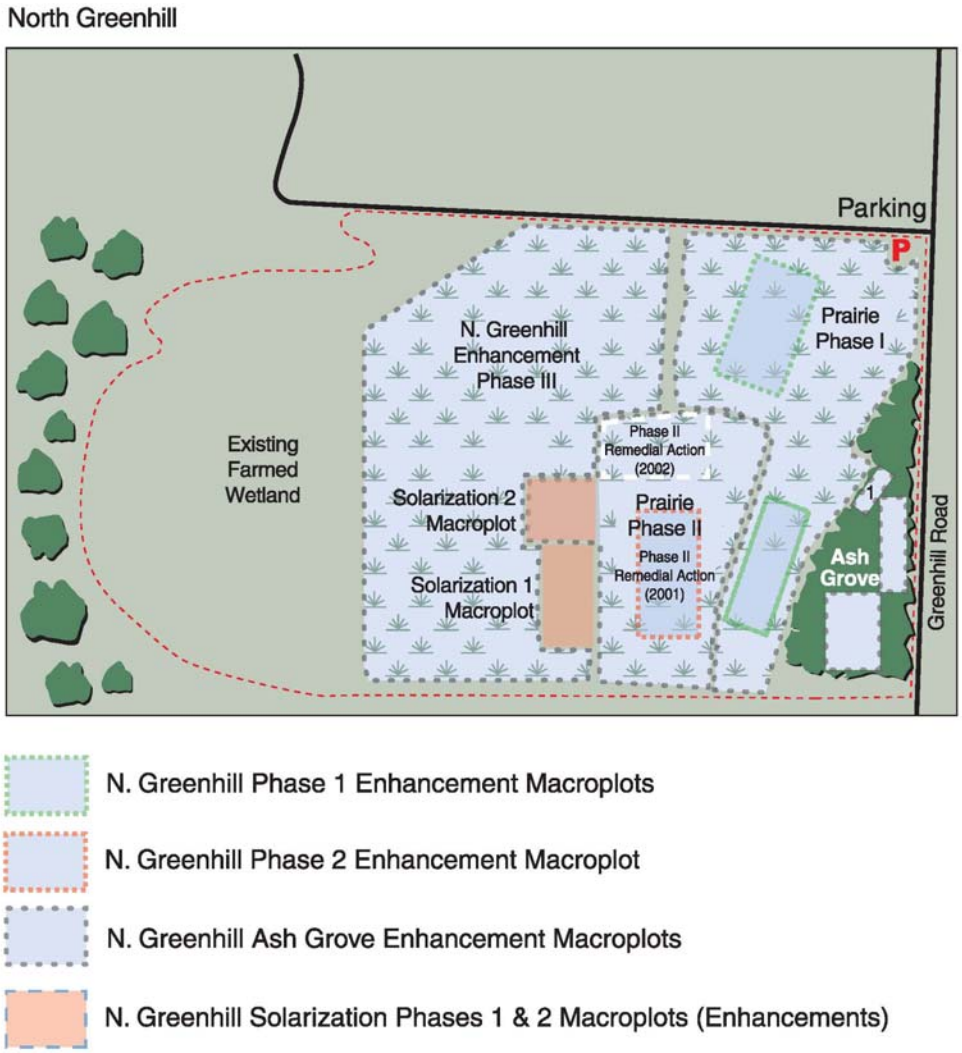


Figure 11.1. North Greenhill Prairie Site Map. The Enhancement Ash Grove area, Phases 1, 2, and 3 sod-removal enhancements as well as Phases 1 and 2 solarization enhancements are labeled with their associated macroplots.

B. 2003 Monitoring Summary

2003 was the final year of monitoring for North Greenhill Phase 1 Sod-removal and Phase 1 Solarization. Both enhancements have demonstrated wetland soils and hydrology. They also met the mitigation vegetation standard of 70% native cover after 5 years. Phase 1 Sod-Removal met the criterion that all species occurring at 20% cover or greater be native, but Phase 1 Solarization did not. Neither the sod-removal nor the solarization met the criterion that a minimum of 10 species occurring at 2% cover or greater be native. Macroplot 1 of the sod-removal had 7 native species with greater than 2% cover and macroplot 2 had 8. The macroplot in the solarization had 2 native species with greater than 2% cover. The City of Eugene and the BLM will be using prescription burning, followed by seeding in both the solarization and the sod-removal to decrease the cover of native perennial grasses and increase the cover of native forbs.

Phase 2 Sod-removal received 2nd year monitoring in 2003. This included soil pits to check for wetland soils and hydrology; both are present. In mid-April, the water table was between 1 and 3 inches. Point-intercept cover monitoring is done in the second year to make sure the site meets the vegetation standard of 50% native cover. Native vegetation on Phase 2 was 80.7% of the total cover.

No significant changes occurred in Phase 2 Solarization. Hydrology monitoring indicates that the site continues to support wetland hydrology. No quantitative monitoring was scheduled in 2003 for Phase 2 Solarization.

This was the first growing season for Phase 3. The seed assessment revealed similar results to the seed assessments for other sod-removals, indicating that the site should meet 2nd year vegetation goals. A total of 67 species were planted in 4 different mixes (wet prairie, emergent, vernal pool, and upland prairie mixes). In all habitats, 36 of the species planted were observed. Many emergent and upland prairie species were not found, likely because of the lack of suitable habitat—the majority of the site is wet prairie. Additionally, many species not observed, particularly the bulbs, are not observed until year 4 or 5 after restoration. To ensure greater species diversity, plugs and bulbs of 8 species were planted in the fall of 2003.

2003 Management Actions

Phase 1:

1. A maintenance crew spent four and a half days removing non-native species from the area.
2. The site perimeter was mowed to reduce weed invasion.

Phase 2:

1. A maintenance crew spent sixteen and a half days removing non-native species from the area.
2. The site perimeter was mowed to reduce weed invasion.
3. Plugs and bulbs of the following species were planted in October of 2003 in the quantities specified: 1) *Triteleia hyacinthina* (3 flats of 1-year old bulbs and 33 2-year old 'conetainers' sometimes with multiple bulbs), 2) *Perideridia oregana* (26 'conetainers' sometimes with multiple plants of 1-year old plants), 3) *Camassia quamash* var. *maxima* (4 trays of 1" cells—1-year old), 4) *Dichelostemma congestum* (2 trays of 1" cells and 1 flat—all 1-year old), 5) *Deschampsia cespitosa* (1 flat), 6) *Danthonia californica* (1 flat), 7) *Allium amplectens* (3 flats—1-year old), 8) *Brodiaea coronaria* (33 2-year old 'conetainers' sometimes with multiple bulbs),

and 9) *Zigadenus venosus* var. *venosus* (33 2-year old 'conetainers' sometimes with multiple bulbs and 1 flat).

Phase 3:

1. A maintenance crew spent a month removing non-native species from the area.
2. The site perimeter was mowed to reduce weed invasion.
3. Plugs and bulbs of the following species were planted in October of 2003 in the quantities specified: 1) *Perideridia oregana* (25 'conetainers' sometimes with multiple 1-year old plants), 2) *Camassia leichtlinii* (3 flats of 1-year old bulbs), 3) *Dichelostemma congestum* (1 trays of 1" cells and 2 flats—all 1-year old bulbs), 4) *Carex unilateralis* (1 tray of 1" cells), 5) *Carex densa* (1 flat), 6) *Allium acuminatum* (1 flat of 1-year old bulbs), 7) *Brodiaea coronaria* (66 1-year old 'conetainers' sometimes with multiple bulbs and 2 flats of 1-year old bulbs), and 8) *Zigadenus venosus* var. *venosus* (66 1-year old 'conetainers' sometimes with multiple bulbs).

1. Management Actions for 2004

Phase 1:

This site is off-line next year. Future management will be done by the BLM.

Phase 2:

1. Continue hand weeding as was done in 2003. Based on last year's weeding, special attention should be given to hairy cat's ear (*Hypochaeris radicata*), Centaury (*Centauria erythraeae*), and Parentucellia (*Parentucellia viscosa*).
2. Smooth and re-seed the wet pocket near the southeast corner of Phase 2.

Phase 3:

1. Hand-weed the restoration area.
2. Solarize areas located on the east and south sides of the pond area to prep these weedy areas for re-planting in 2005 or 2006. Woody species could also be added at that time.

Table 11.2. Progress of the North Greenhill Unit Enhancements towards meeting the MIP vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the site's MIP. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MOA Vegetation Standards	Phase 1				Phase 2				Phase 3	
	Sod-Removal	Goal Met?	Solarization	Goal Met?	Sod-Removal	Goal Met?	Solarization	Goal Met?	Sod-Removal	Goal Met?
Site status in the monitoring period	Year 5 of 5	N/A	Year 5 of 5	N/A	Year 3 of 6	N/A	Year 3 of 5	N/A	Year 1 of 5	N/A
Most recent point-intercept cover data collected in:	2003	N/A	2003	N/A	2003	N/A	2002	N/A	2004	N/A
50% native **cover** after 2 years	MP1 = 54% MP2 = 70%	Yes	84%	Yes	81%	TBD	82%	Yes	2004	TBD
70% native **cover** after 5 years	MP1 = 87% MP2 = 93%	Yes	77%	Yes	2006	TBD	2005	TBD	2007	TBD
70% of the species occurring at 20% **cover** or greater are native	MP1 = 100% MP2 = 100%	Yes	50%	No	2006	TBD	2005	TBD	2007	TBD
Minimum of 10 native species occurring at 2**% cover** or greater	MP1 = 7 MP2 = 8	No	2	No	2006	TBD	2005	TBD	2007	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during site visits in early spring for all phases. Water depths were measured periodically at 2 staff gauges in Phase 1.

b) Results

Phase 1

Hydrology monitoring indicates that the site continues to have saturated or inundated soils during much greater than 15 % of the growing season. Therefore, the hydrology is sufficient to promote and maintain hydric soil development. During April of 2003, 20% of the site was inundated and 95% was saturated to the soil surface.

Phase 2

Hydrology monitoring in 2003 consisted of both hydrography mapping and pits to measure the depth to the water table from the soil surface. Approximately 5% of the site was inundated and 100% was saturated to the soil surface. Depths to the water table ranged from 1.5 inches to 3 inches. Hydrology on the site is sufficient for the development and maintenance hydric soils.

Phase 3

The site was approximately 5% inundated and 100% saturated on April 11th of 2003. The site appears to by exhibit wetland hydrology, but pits will be dug in the spring of 2004 to confirm its persistence after restoration.

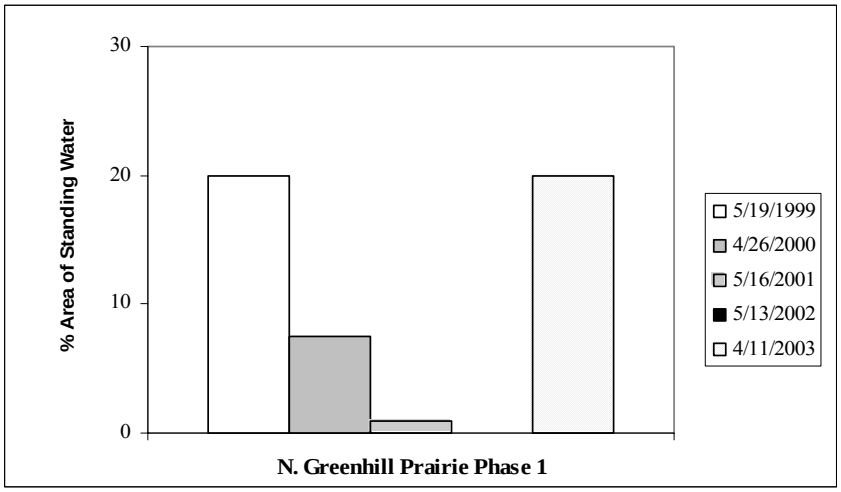


Figure 11.2. Spring standing water in Phase 1 of the N. Greenhill Prairie Unit. Percentage of Phase 1 with standing water in the early spring over the history of the restoration.

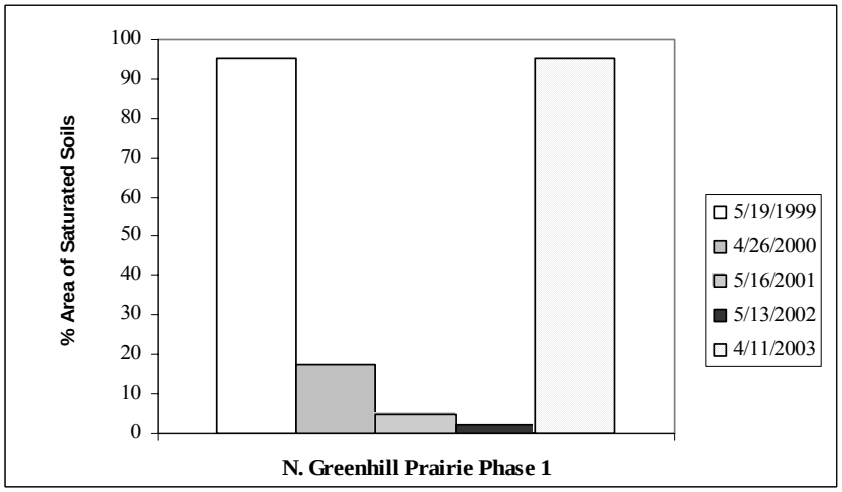


Figure 11.3. Spring saturated soils in Phase 1 of the N. Greenhill Prairie Unit. Percentage of the Phase 1 with saturated soils in the early spring over the history of the restoration.

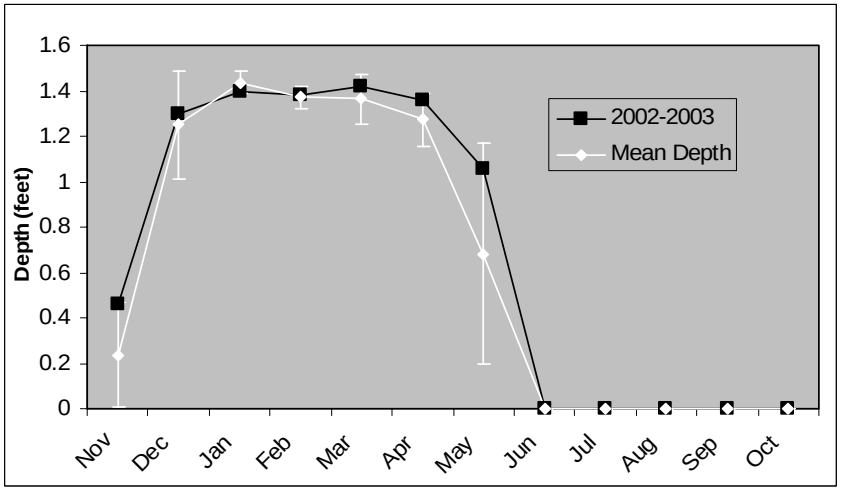


Figure 11.4. N. Greenhill Prairie Unit inundation levels in the northeastern vernal pool during 2002-2003 compared to the mean and standard deviation of depths between 1998 and 2003. Depth of inundation throughout the year in the northeastern area over 2002-2003. The mean and standard deviation calculated from depths observed between 1998 and 2003 are graphed for comparison.

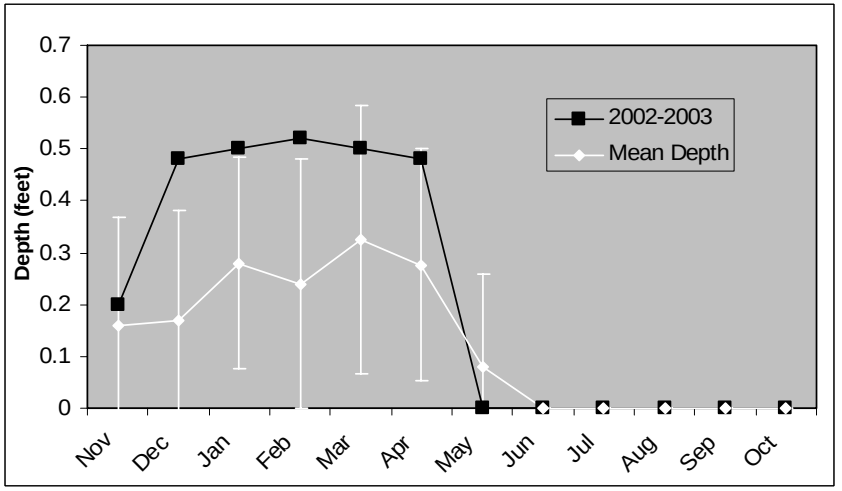


Figure 11.5. N. Greenhill Prairie Unit inundation levels in the southern vernal pool during 2002-2003 compared to the mean and standard deviation of depths between 1999 and 2003. Depth of inundation throughout the year in the southern section over the history of the restoration. The mean and standard deviation calculated from depths observed between 1999 and 2003 are graphed for comparison.

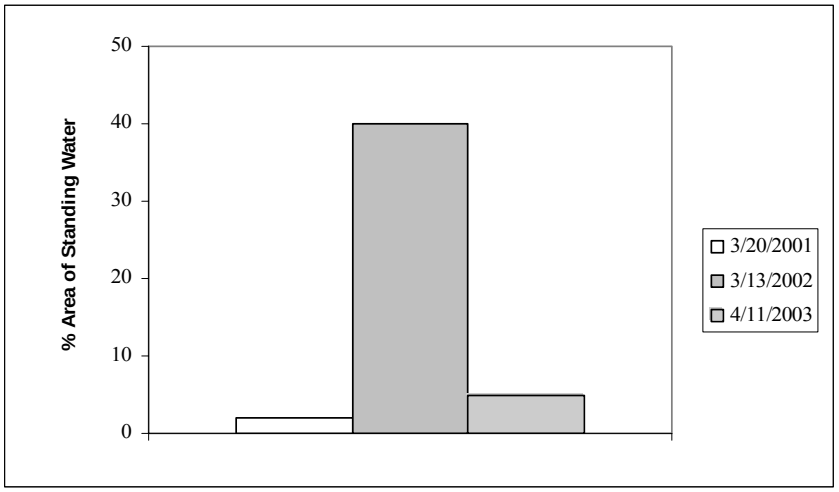


Figure 11.6. Spring standing water in Phase 2 of the N. Greenhill Prairie Unit. Percentage of Phase 2 with standing water in the early spring over the history of the restoration.

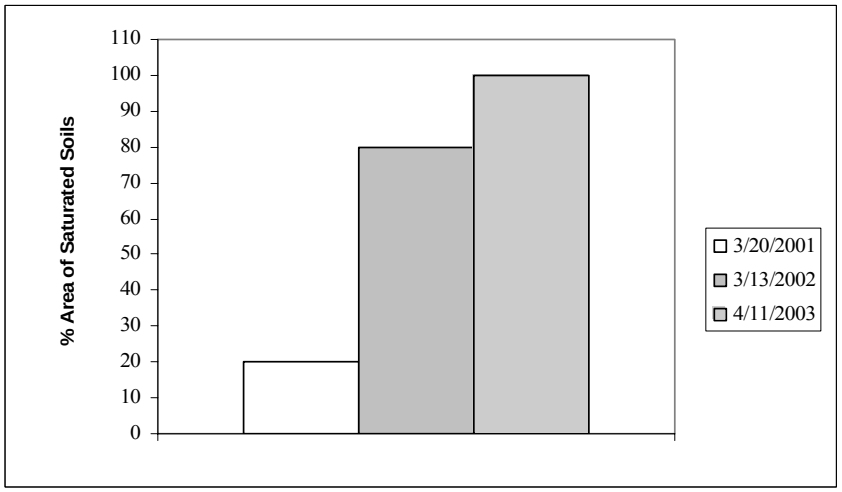


Figure 11.7. Spring saturated soils in Phase 2 of the N. Greenhill Prairie Unit. Percentage of the Phase 2 with saturated soils in the early spring over the history of the restoration.

2. Vegetation

a) Methods

Point-intercept data were collected in the Phases 1 and 2 (sod-removals) in 2003. In Phase 1, two macroplots were sampled. Macroplot 1 was sampled June 23rd through 25th for a total of 253 points and macroplot 2 was sampled June 20th and 23rd for a total of 226 points. In Phase 2, 1 macroplot was sampled on May 29th. A total of 220 points were sampled. A seed assessment was completed for Phase 3 on June 12th.

A species list for each phase was also compiled and/or updated and can be viewed in Appendix B.

b) Results

Phase 1 Sod-Removal Enhancement: Point-intercept Results

In both macroplots of the Phase 1 Sod-Removal the proportion of native cover compared to the total cover is greater than 70%. Macroplot 1 had 87% native cover and macroplot 2 had 93% cover. Both macroplots also had significantly higher cover of *Deschampsia cespitosa* and *Lotus unifoliatus* ($\alpha = .10$) than the other species. In Macroplot 1, *Deschampsia cespitosa* had a percent cover of 31%, while it was 38% in macroplot 2. Lotus unifoliatus was 18% in macroplot 1 and 38% in macroplot 2. All other species detected during point-intercept sampling had a percent cover of less than 20%, while most were less than 3%. The restoration did not meet the goal of 10 native species occurring at 2% cover or greater.

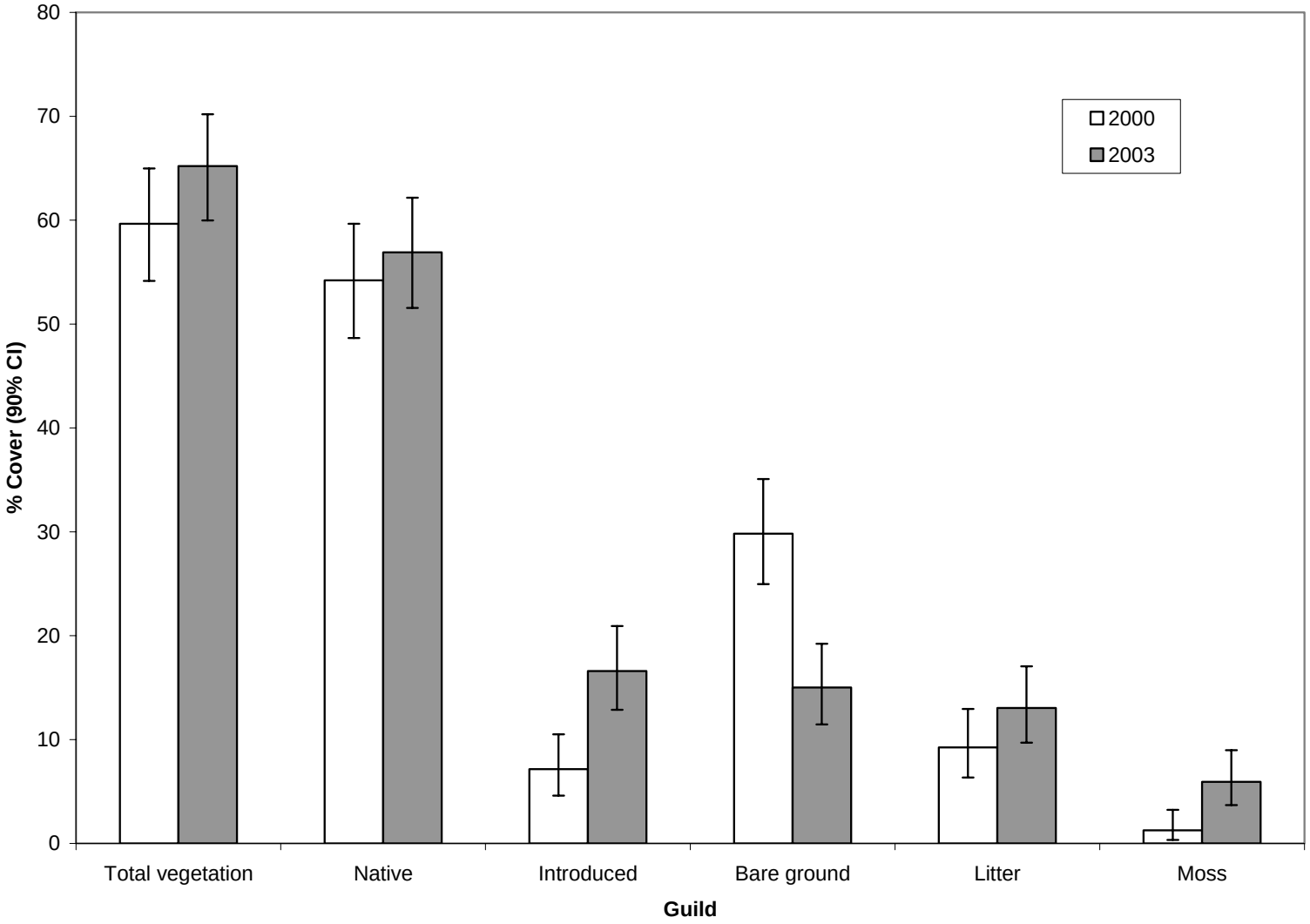


Figure 11.8. Percent cover of ground cover guilds in Macroplot 1 of the North Greenhill Phase 1 Sod-Removal Enhancement. The total percent cover of all vegetation, native species, introduced species, and bare ground are graphed for macroplot 1 of the North Greenhill Phase 1 Sod-Removal Enhancement. Data were collected for each trial the 5th year after planting.

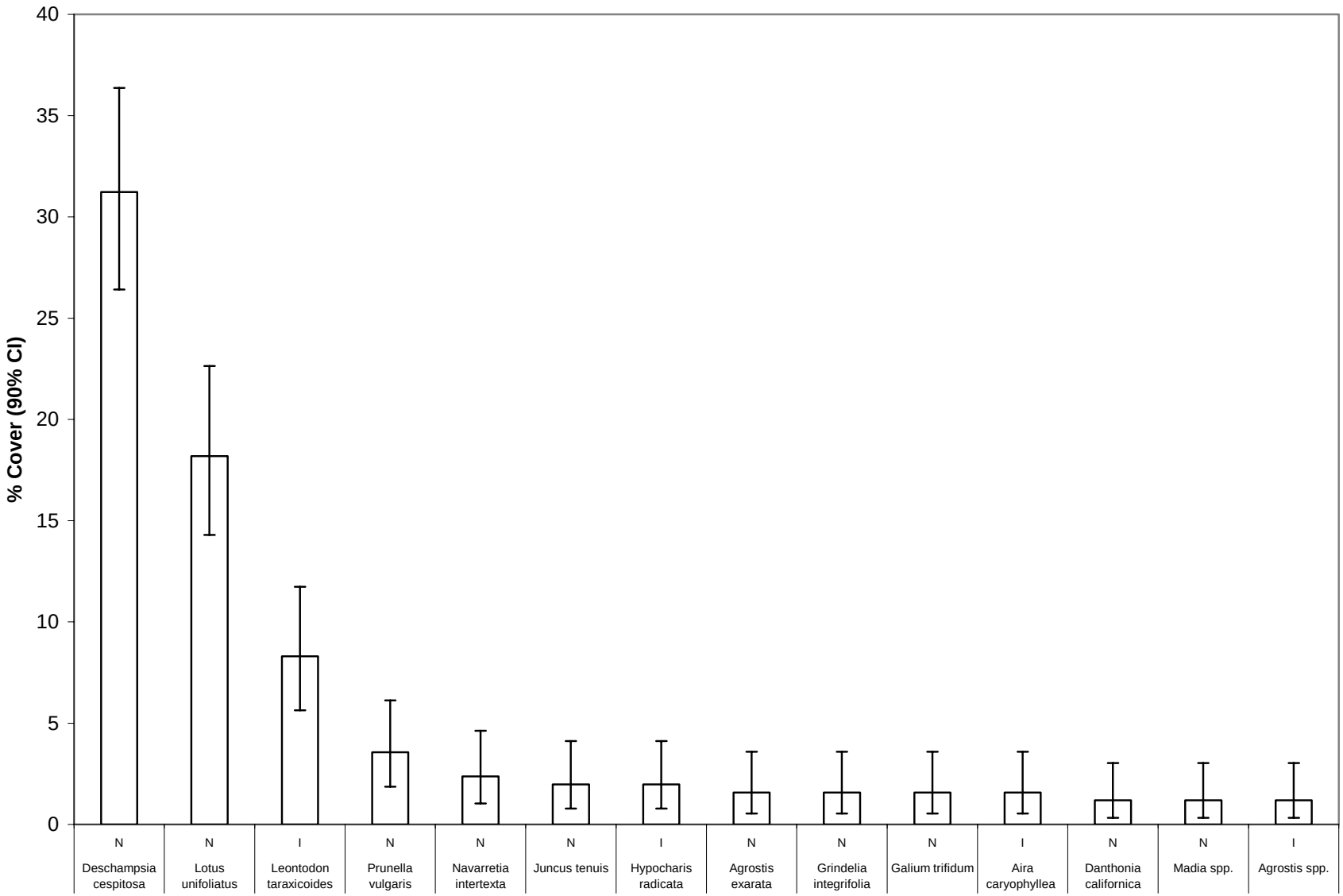


Figure 11.9. Species in the North Greenhill Phase 1 Sod-Removal, Macroplot 1, with > 1% cover. All species in 2003 with greater than one percent cover are graphed for North Greenhill Phase 1 Sod-Removal, Macroplot 1. Data were collected the 5th year after restoration.

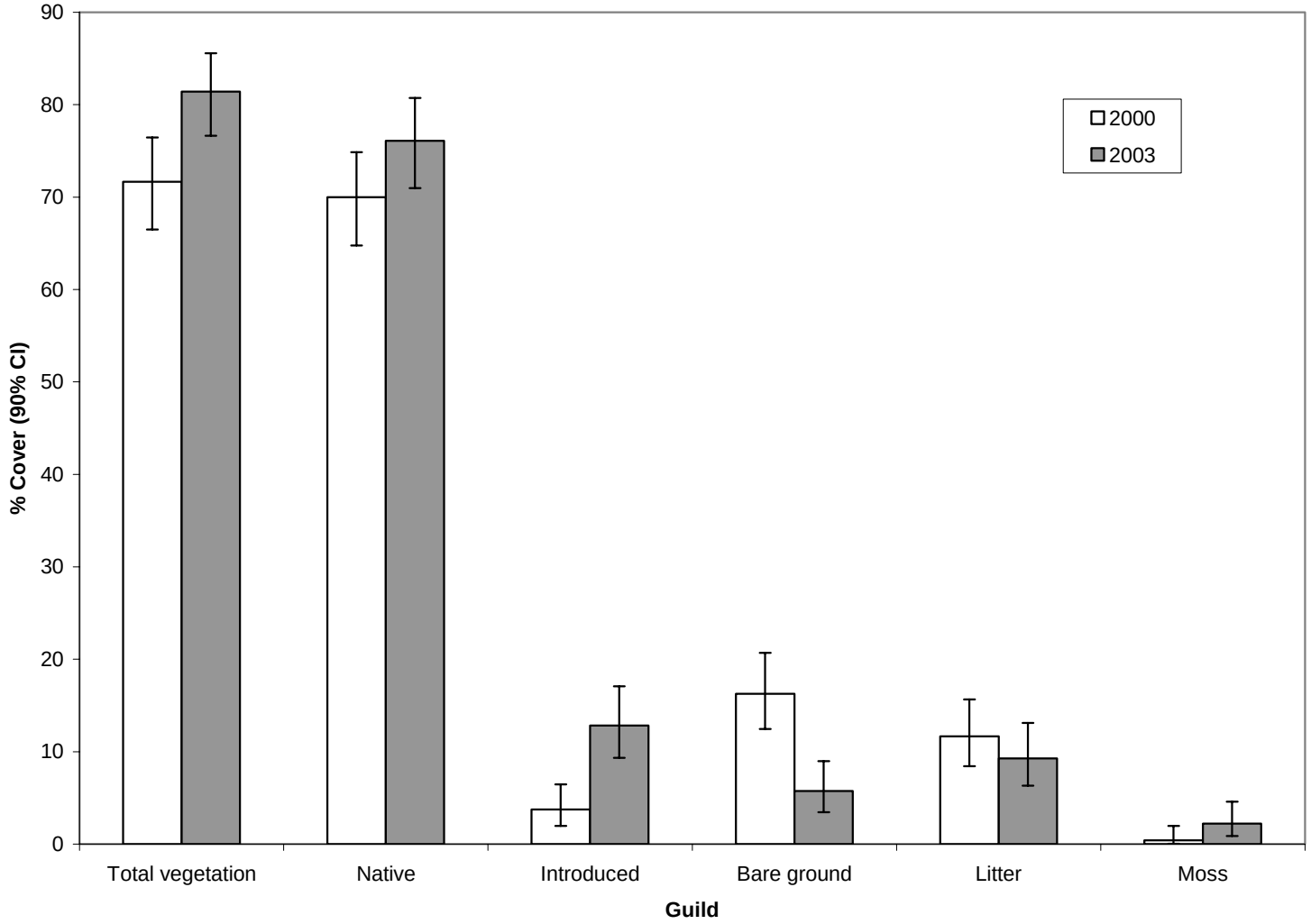


Figure 11.10. Percent cover of ground cover guilds in Macroplot 2 of the North Greenhill Phase 1 Sod-Removal Enhancement. The total percent cover of all vegetation, native species, introduced species, and bare ground are graphed for macroplot 2 of the North Greenhill Phase 1 sod-removal enhancement. Data were collected the 5th year after planting.

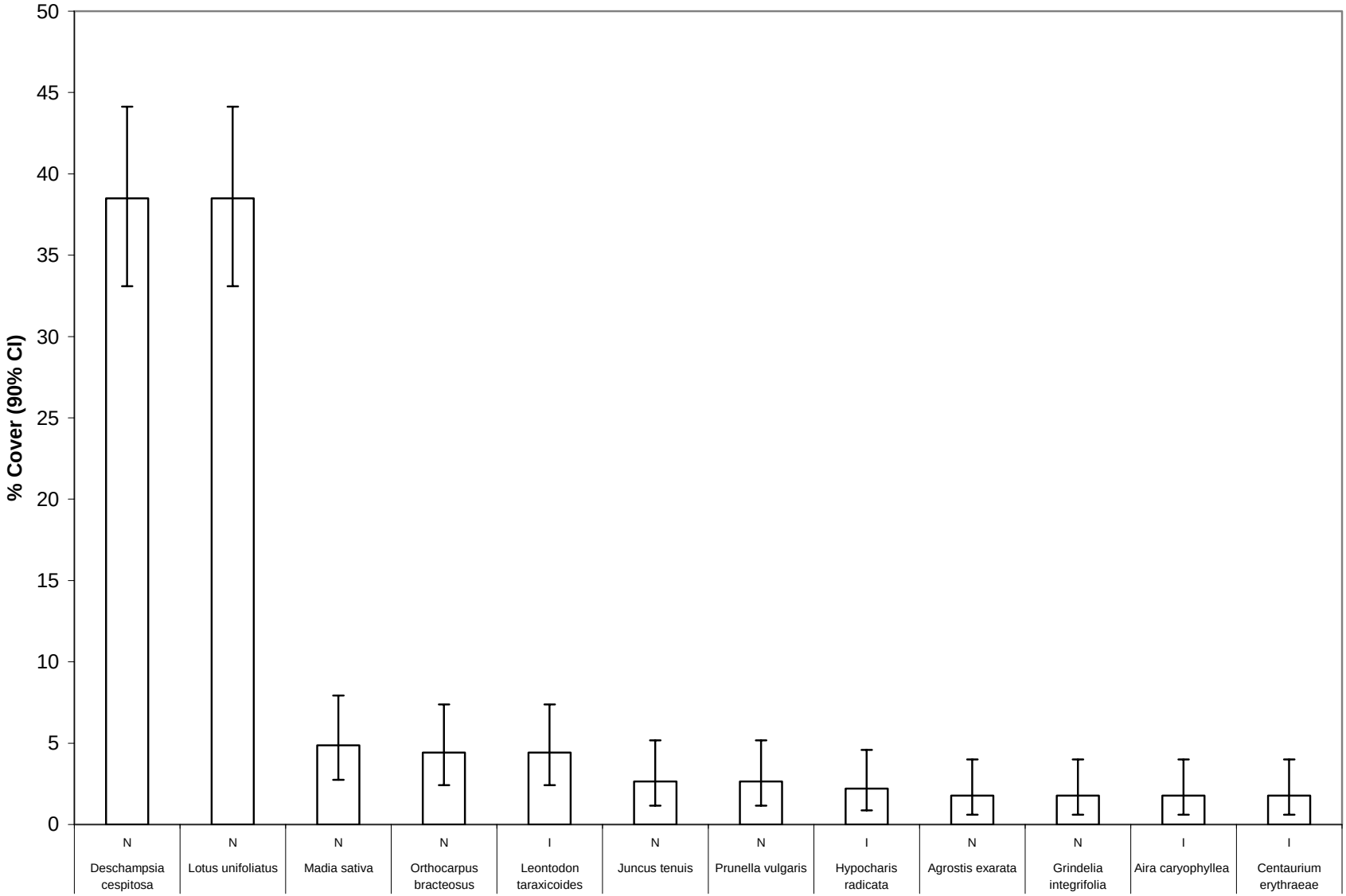


Figure 11.11. Species in the North Greenhill Phase 1 Sod-Removal, Macroplot 2, with > 1% cover. All species in 2003 with greater than one percent cover are graphed for North Greenhill Phase 1 Sod-Removal, Macroplot 2. Data were collected the 5th year after restoration.

Phase 1 Solarization Enhancement: Point-intercept Results

The Phase 1 Solarization Enhancement had a native cover of 84%. *Deschampsia cespitosa* contributed to the total native cover with an individual percent cover of 69%. After *Holcus lanatus* (42%), all other species had a percent cover of less than 6%. This enhancement did not meet the goal of 10 native species with greater than 2% cover. Only 1 species, *Deschampsia cespitosa*, met this criterion.

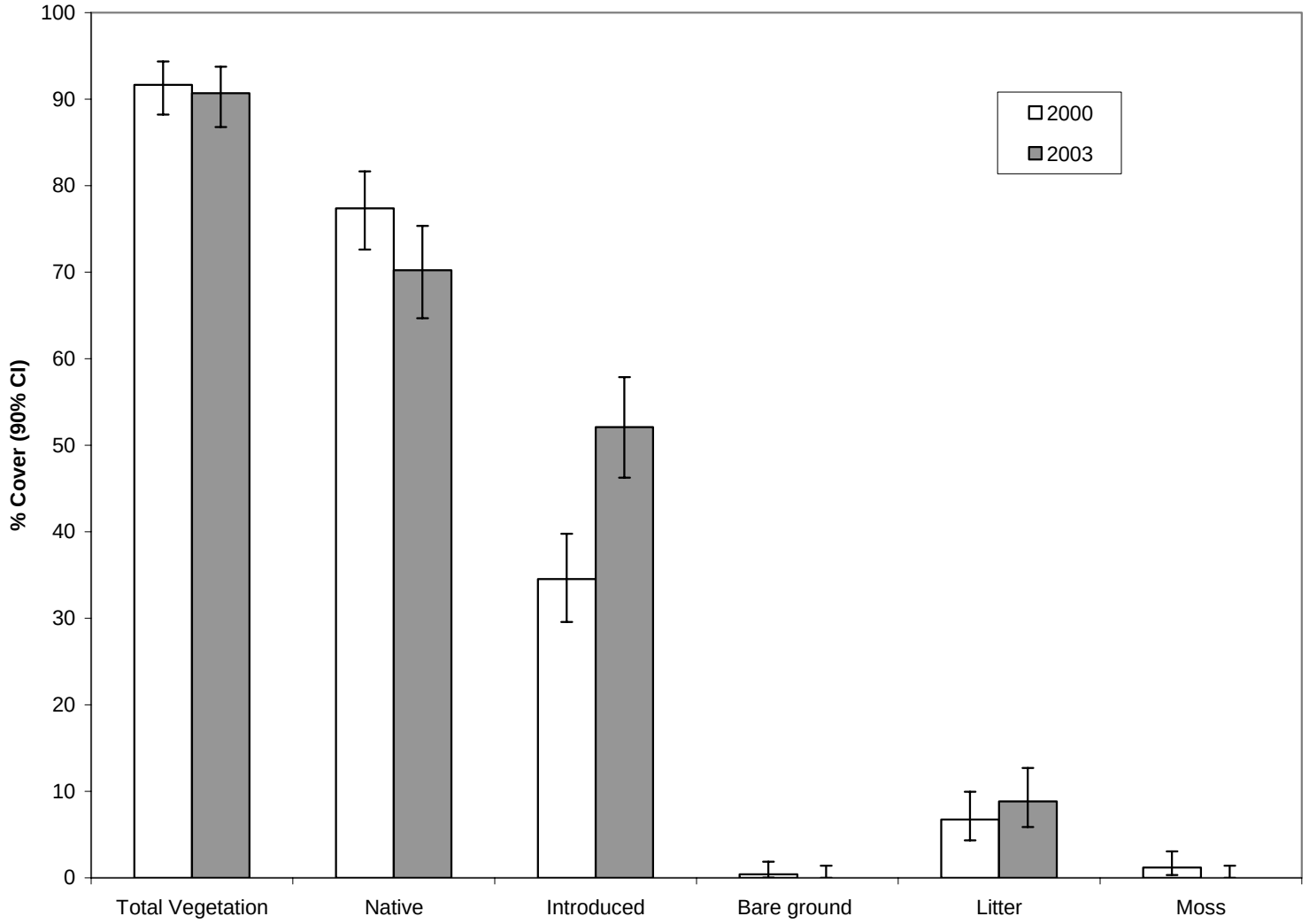


Figure 11.12. Percent cover of ground cover guilds in North Greenhill Phase 1 Solarization Enhancement. The total percent cover of all vegetation, native species, introduced species, and bare ground are graphed for North Greenhill Phase 1 solarization enhancement. Data were collected the 5th year after planting.

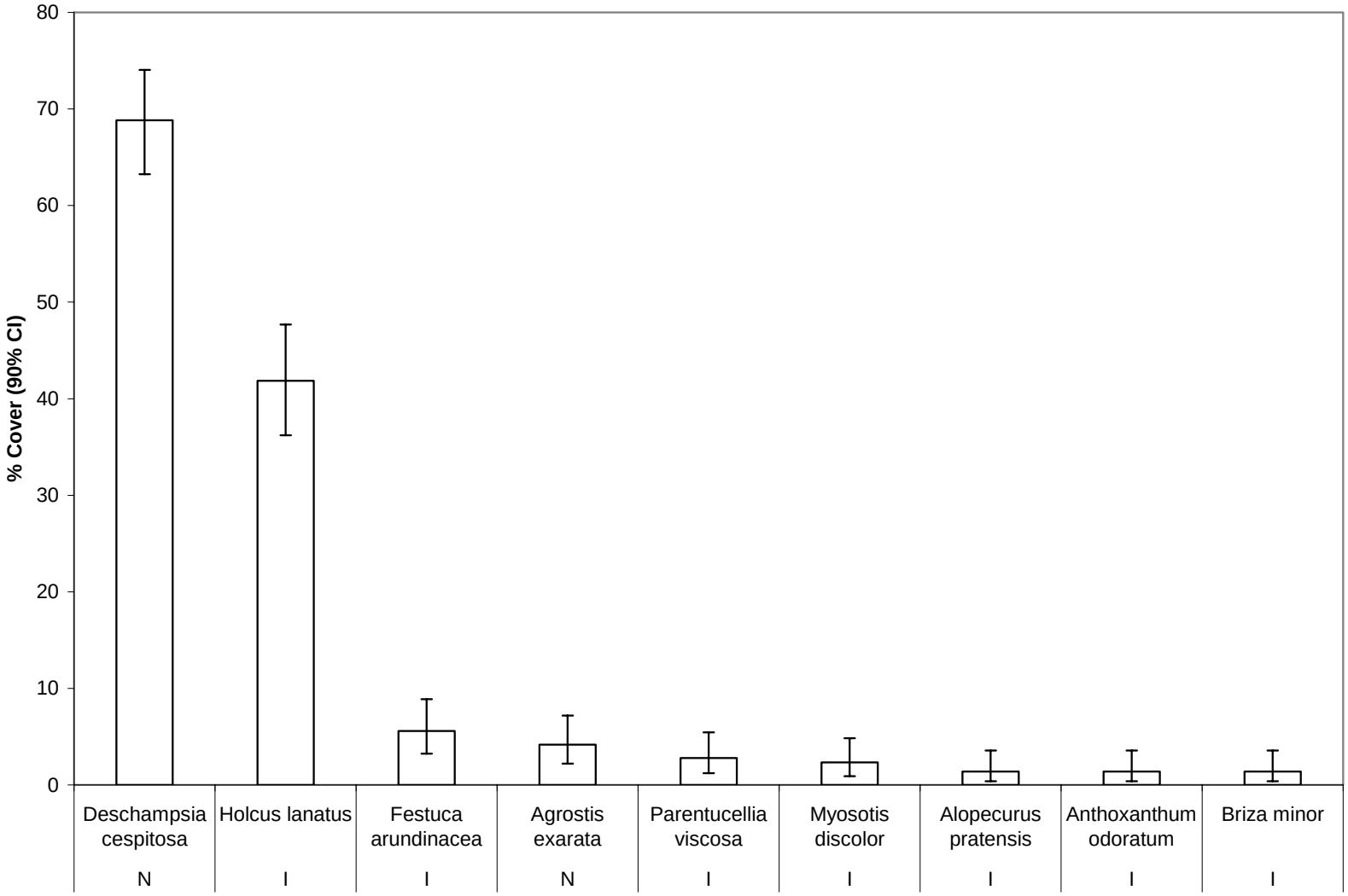


Figure 11.13. Species in the North Greenhill Phase 1 Solarization, with > 1% cover. All species in 2003 with greater than one percent cover are graphed for North Greenhill Phase 1 Solarization. Data were collected the 5th year after restoration.

Phase 2 Sod-Removal Enhancement: Point-intercept Results

Phase 2 sod-removal met the 2nd year vegetation standard. Nearly 81% of the total vegetation was native. While there are no 2nd year vegetation standards for dominance and diversity, *Deschampsia cespitosa* was the dominant species, with greater than 25% cover. Additionally, 8 other species had cover values of greater than 1%. These included *Agrostis exarata*, *Madia* spp., *Eriophyllum lanatum*, *Phlox gracilis*, *Gratiola ebractata*, *Microseris laciniata*, *Plagiobothrys figuratus*, and *Prunella vulgaris*.

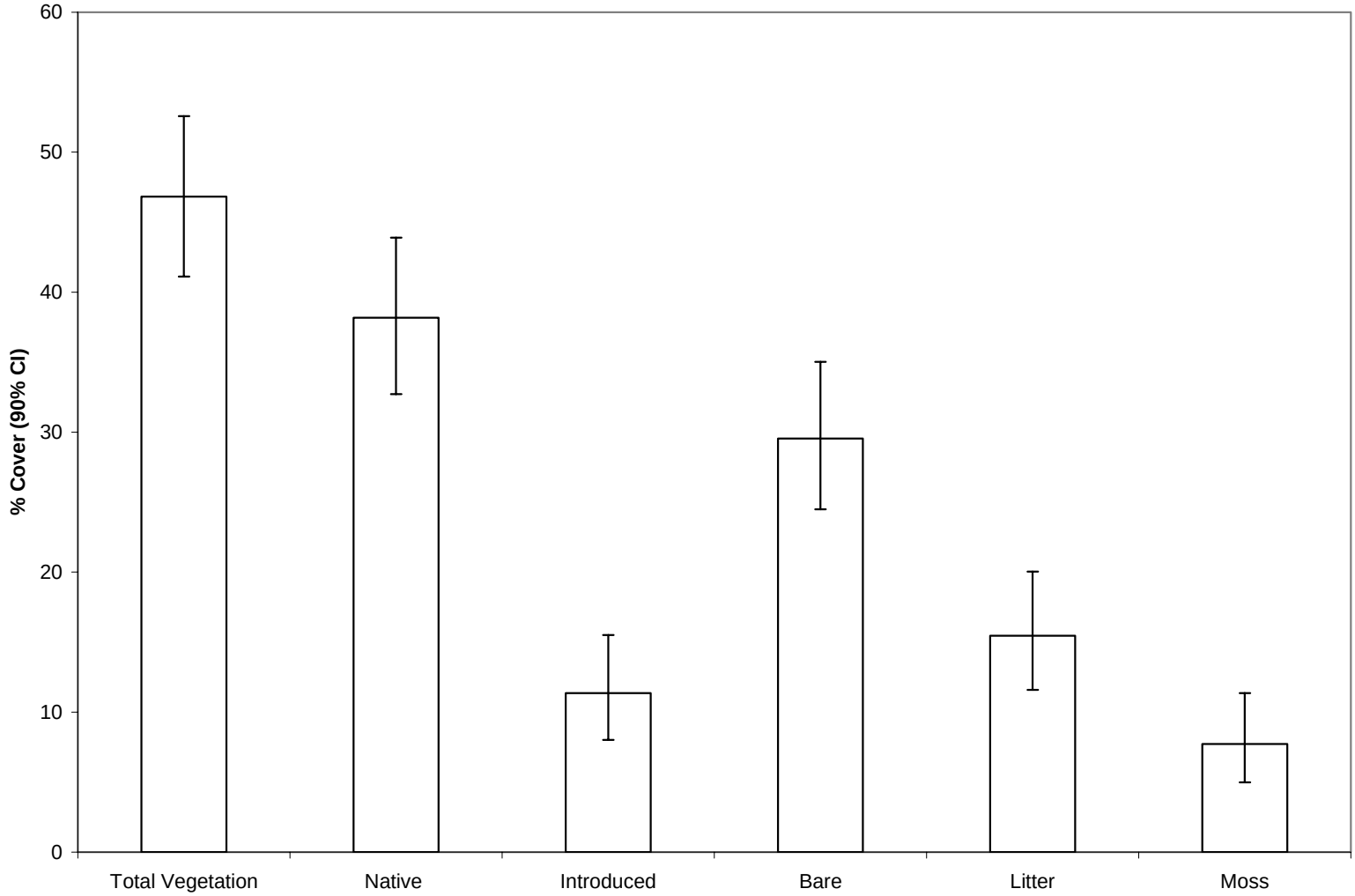


Figure 11.14. Percent cover of ground cover guilds in North Greenhill Phase 2 Sod-removal Enhancement. The total percent cover of all vegetation, native species, introduced species, and bare ground are graphed for North Greenhill Phase 2 sod-removal enhancement. Data were collected the 2nd year after planting.

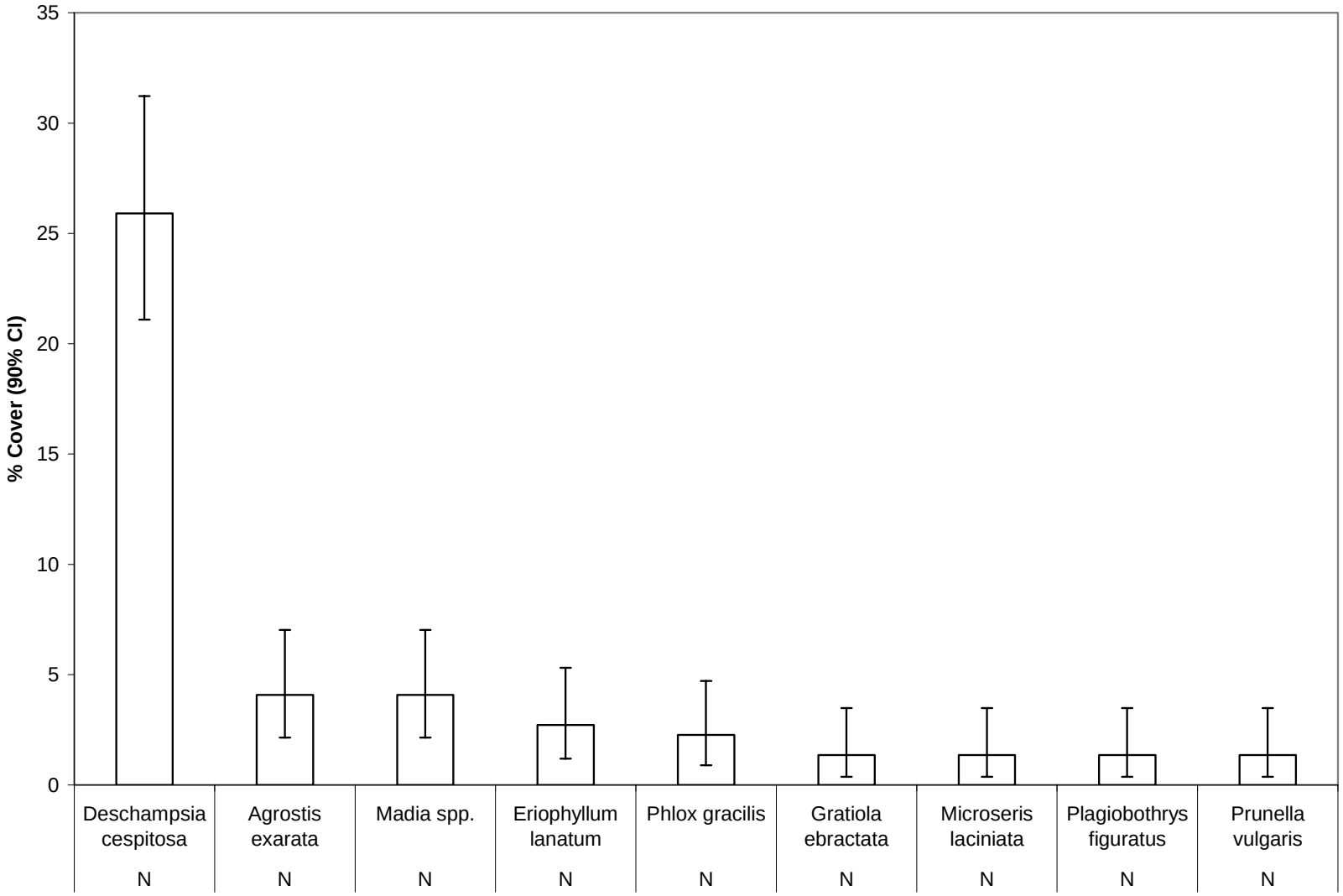


Figure 11.15. Species in the North Greenhill Phase 2 Sod-removal with > 1% cover. All species in 2003 with greater than one percent cover are graphed for North Greenhill Phase 2 Sod-removal. Data were collected the 2nd year after restoration.

Phase 3 Sod-Removal Enhancement: Seed Assessment Results

Four mixes were planted in Phase 3 of North Greenhill. These included 20 acres of wet prairie mix, 5 acres of vernal pool mix, 0.5 acres of emergent mix, and 0.5 acres of upland prairie. Of the 42 species included in the wet prairie mix, 2 received a rating of 'Dominant,' 10 received a rating of 'Common,' 7 were 'Uncommon,' 2 were only observed in 'Trace' amounts, and 21 species were not seen. Both species that received 'Dominant' ratings were grasses (*Deschampsia cespitosa* and *Agrostis exarata*).

The vernal pool mix contained 23 species. *Downingia* spp. and *Plagiobothrys figuratus* both received 'Dominant' ratings. Of the remaining species, 4 were 'Common,' 8 were 'Uncommon,' and 5 were observed in 'Trace' amounts. The remaining 3 species were not observed

Of the 28 species included in the emergent mix, none received a 'Dominant' rating. The number of species receiving a 'Common,' 'Uncommon,' and 'Trace' rating were 3, 4, and 6 respectively. The remaining 15 species were not observed. This was likely caused by the lack of emergent habitat in the restoration.

The upland mix contained 13 species. None of them received a 'Dominant' rating. The categories of 'Common,' 'Uncommon,' and 'Trace' all had 2 species in each. Seven species were not observed. This also may be due to the lack of upland habitat.

Table 11.3. North Greenhill Phase 3 wet prairie areas seed assessment. A total of 20 acres were seeded with a wet prairie plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, their USFWS wetland habitat designation, the total weight of each species included, the weight of seed used per acre planted, and the percentage of each mix the seed occupied.

Scientific Name	Rank	Habitat	Grams	grams/acre	% of mix
Agrostis exarata	Dominant	FACW	4600	230	9.96%
Allium amplectens		NOL*	60	3	0.13%
Aster hallii		NOL*	2000	100	4.33%
Brodiaea coronaria		NOL*	20	1	0.04%
Brodiaea hyacinthina		NOL*	20	1	0.04%
Camassia leichtlinii		FACW-	400	20	0.87%
Camassia quamash		FACW*	1200	60	2.60%
Carex densa		OBL	1200	60	2.60%
Carex unilateralis		FACW	2000	100	4.33%
Castelleja tenuis	Uncommon	NOL*	148	7.4	0.32%
Danthonia californica		FACU*	2300	115	4.98%
Deschampsia cespitosa	Dominant	FACW	5000	250	10.82%
Downingia elegans & yina	Common	OBL	140	7	0.30%
Downingia yina	Common	OBL	1000	50	2.16%
Epilobium densiflorum	Common	FACW-	2000	100	4.33%
Eriophyllum lanatum	Common	NOL*	1000	50	2.16%
Grindelia integrifolia	Uncommon	FACW	1000	50	2.16%
Hordeum brachyantherum	Common	FACW-*	6000	300	12.99%
Juncus ensifolius	Trace	FACW	40	2	0.09%
Juncus tenuis		FACW-	800	40	1.73%
Lotus formosissimus		FACW+	100	5	0.22%
Lotus purshianus	Uncommon	NOL*	300	15	0.65%

Table 11.3. North Greenhill Phase 3 wet prairie areas seed assessment. A total of 20 acres were seeded with a wet prairie plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, their USFWS wetland habitat designation, the total weight of each species included, the weight of seed used per acre planted, and the percentage of each mix the seed occupied.

Scientific Name	Rank	Habitat	Grams	grams/acre	% of mix
Lupinus polyphyllus		FAC+	600	30	1.30%
Lupinus rivularis	Uncommon	FACU	1000	50	2.16%
Luzula campestris		NOL*	40	2	0.09%
Madia glomerata	Uncommon	FACU+	400	20	0.87%
Madia sativa	Common	NOL*	600	30	1.30%
Microseris laciniata	Common	NOL*	2000	100	4.33%
Orthocarpus bracteosus	Uncommon	NOL*	100	5	0.22%
Panicum occidentale		FACW	100	5	0.22%
Perideridia gairdneri ssp. borealis		NOL*	51	2.55	0.11%
Perideridia oregana		NOL*	100	5	0.22%
Plagiobothrys figuratus	Common	FACW	1230	61.5	2.66%
Potentilla gracilis		FAC	1351	67.55	2.92%
Prunella vulgaris	Common	FACU+	1000	50	2.16%
Ranunculus occidentalis	Uncommon	FAC	1600	80	3.46%
Ranunculus orthorhynchus	Common	FACW-	2000	100	4.33%
Rumex salicifolius		FACW	600	30	1.30%
Saxifraga oregana		FACW+	20	1	0.04%
Sisyrinchium idahoense		FACW	60	3	0.13%
Wyethia angustifolia	Trace	FACU	2000	100	4.33%
Zigadenous venenosus		FACU*	20	1	0.04%

Table 11.4. North Greenhill Phase 3 vernal pool areas seed assessment. A total of 5 acres were seeded with a vernal pool plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, their USFWS wetland habitat designation, the total weight of each species included, the weight of seed used per acre planted, and the percentage of each mix the seed occupied.

Scientific Name	Rank	Habitat	Grams	grams/acre	% of mix
Agrostis exarata	Uncommon	FACW	1150	230	5.81%
Beckmannia syzigachne	Trace	OBL	12000	2400	60.65%
Deschampsia cespitosa	Trace	FACW	500	100	2.53%
Downingia eleg. + yina	Dominant	OBL	175	35	0.88%
Downingia yina	Dominant	OBL	250	50	1.26%
Epilobium densiflorum	Common	FACW-	200	40	1.01%
Eryngium petiolatum	Uncommon	OBL	110	22	0.56%
Glyceria occidentalis	Trace	OBL	250	50	1.26%
Gnaphalium palustre	Common	FAC+	50	10	0.25%
Gratiola ebracteata	Common	OBL	500	100	2.53%
Hordeum brachyantherum	Uncommon	FACW-*	3000	600	15.16%
Juncus acuminatus	Trace	FACQ-	250	50	1.26%
Juncus bolanderi		OBL	50	10	0.25%
Juncus ensifolius		FACW	10	2	0.05%
Lasthenia glaberrima	Trace	OBL	250	50	1.26%
Madia glomerata	Uncommon	FACU+	100	20	0.51%
Microsteris gracilis	Uncommon	FACU	50	10	0.25%
Navarretia intertexta	Common	FACW	125	25	0.63%
Plagiobothrys figuratus	Dominant	FACW	315	63	1.59%

Table 11.4. North Greenhill Phase 3 vernal pool areas seed assessment. A total of 5 acres were seeded with a vernal pool plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, their USFWS wetland habitat designation, the total weight of each species included, the weight of seed used per acre planted, and the percentage of each mix the seed occupied.

Scientific Name	Rank	Habitat	Grams	grams/acre	% of mix
Psilocarphus elatior	Uncommon	FACW	25	5	0.13%
Rorripa curvisiliqua	Uncommon	OBL	100	20	0.51%
Rumex salicifolius		FACW	150	30	0.76%
Veronica peregrina	Uncommon	OBL	175	35	0.88%

Table 11.5. North Greenhill Phase 3 emergent areas seed assessment. A total of 2.5 acres were seeded with an emergent plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, their USFWS wetland habitat designation, the total weight of each species included, the weight of seed used per acre planted, and the percentage of each mix the seed occupied.

Scientific Name	Rank	Habitat	Grams	grams/acre	% of mix
Agrostis exarata	Uncommon	FACW	580	232	5.76%
Alisma plantago-aquatica	Uncommon	OBL	250	100	2.48%
Beckmannia syzigachne	Trace	OBL	6000	2400	59.62%
Carex densa		OBL	50	20	0.50%
Downingia elegegans & yina	Common	OBL	87.5	35	0.87%
Downingia yina	Common	OBL	125	50	1.24%
Eleocharis ovata		OBL	60	24	0.60%
Eleocharis palustris		OBL	162.5	65	1.61%
Epilobium densiflorum	Common	FACW-	100	40	0.99%
Eryngium petiolatum		OBL	55	22	0.55%
Glyceria occidentalis	Trace	OBL	250	100	2.48%
Gnaphalium palustre	Trace	FAC+	25	10	0.25%
Hordeum brachyantherum	Uncommon	FACW-*	1000	400	9.94%
Juncus acuminatus	Trace	FACW-	125	50	1.24%
Juncus bolanderi		OBL	25	10	0.25%
Juncus ensifolius		FACW	5	2	0.05%
Juncus oxymeris		FACW+	75	30	0.75%
Juncus patens		FACW	75	30	0.75%
Ludwigia palustris		OBL	50	20	0.50%
Madia glomerata	Uncommon	FACU+	50	20	0.50%
Myosotis laxa	Trace	OBL	12.5	5	0.12%
Polygonum hydropiperoides		OBL	150	60	1.49%
Ranunculus alismafolius		FACW	75	30	0.75%
Rorripa curvisiliqua		OBL	50	20	0.50%
Rumex salicifolius		FACW	75	30	0.75%
Scirpus validus		OBL	250	100	2.48%
Sparganium emersum		OBL	112.5	45	1.12%
Veronica scutellata	Trace	OBL	187.5	75	1.86%

Table 11.6. North Greenhill Phase 3 upland prairie areas seed assessment. Half an acre was seeded with an upland prairie plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, their USFWS wetland habitat designation, the total weight of each species included, the weight of seed used per acre planted, and the percentage of each mix the seed occupied.

Scientific Name	Rank	Habitat	Grams	grams/acre	% of mix
Camassia leichtlinii		FACW-	30	60	1.72%

Danthonia californica		FACU*	75	150	4.29%
Deschampsia cespitosa	Common	FACW	400	800	22.88%
Elymus glaucus		FACU	1000	2000	57.21%
Eriophyllum lanatum	Trace	NOL*	25	50	1.43%
Lotus purshianus	Trace	NOL*	7.5	15	0.43%
Lupinus polyphyllus		FAC+	7.5	15	0.43%
Lupinus rivularis	Uncommon	FACU	37.5	75	2.15%
Madia sativa	Common	NOL*	25	50	1.43%
Potentilla gracilis		FAC	50	100	2.86%
Prunella vulgaris	Uncommon	FACU+	50	100	2.86%
Ranunculus occidentalis		FAC	25	50	1.43%
Rumex salicifolius		FACW	15	30	0.86%

3. Wildlife Utilization

Wildlife sightings for 2003 were similar to those of previous years. Mallard, Canadian goose, northern harrier, common snipe, and northern flicker were all bird species commonly observed on the site. Evidence of raccoons and deer were again found in the unit. Additionally, a meadowlark nest with 3 chicks was found in Phase 1.

Chapter 12: Oxbow West Unit

A. Site Description

1. Size: 57 acres

2. Ownership: BLM

3. Site Timeline: **Table 12.1 Oxbow West Unit site timeline.**

Section	Treatment and Construction Years	Acreage	Monitoring Period
Forest Enhancement	2003	1.12	2003-2008
Western Wet Prairie Enhancement	2003	4.31	2003-2008
Eastern Wet Prairie Enhancement	2003 & 2004	6.25	2003-2008
Emergent Enhancement	2003	0.29	2004-2008
Emergent Restoration	2003	0.13	2004-2008
Enhanced Wet Prairie and Forest, but we receive no credit (ODOT land)	2003 & 2004	2.50	N/A

4. Location

The Oxbow West Unit is located at the northern end of North Terry Street. It is bordered by Southern Pacific Railroad tracks to the north, Amazon Creek to the east, and Greenhill Technology Park to the south.

5. Baseline Conditions

The site was used as pasture and for hay production until the early to mid-1990s. Currently, the site contained approximately 51 acres of delineated wetlands, most of which is wet prairie of varying quality, with some smaller patches of forested and emergent wetland. Woody vegetation has coloned much of the wet prairie areas. Oxbow West also supports some of the largest known populations of rare and sensitive plants in west Eugene.

6. Focus of Prescriptions

Treatments at Oxbow West will enhance and restore wet prairie, forested, and emergent habitats. Wet prairie and forest enhancement will remove non-native and native woody vegetation, including reed canarygrass and fruit trees. The restoration and enhancement of the emergent area in the southeast will include the removal of fill material and reed canarygrass.

7. Site-Specific Management Goals

1. Protect and enhance existing rare plant populations where they occur and improve habitat suitable for expansion of these populations.
2. Enhance and restore native we prairie and vernal pool communities where they are degraded.
3. Control exotic and woody vegetation in the wet and upland prairie.
4. Control exotic vegetation and selectively remove woody vegetation from the forested wetland areas.
5. Minimize the potential impacts to the site from future increased Greenhill Technology Park stormwater runoff.

6. Minimize human access onto the site while providing visual access from the bike path.

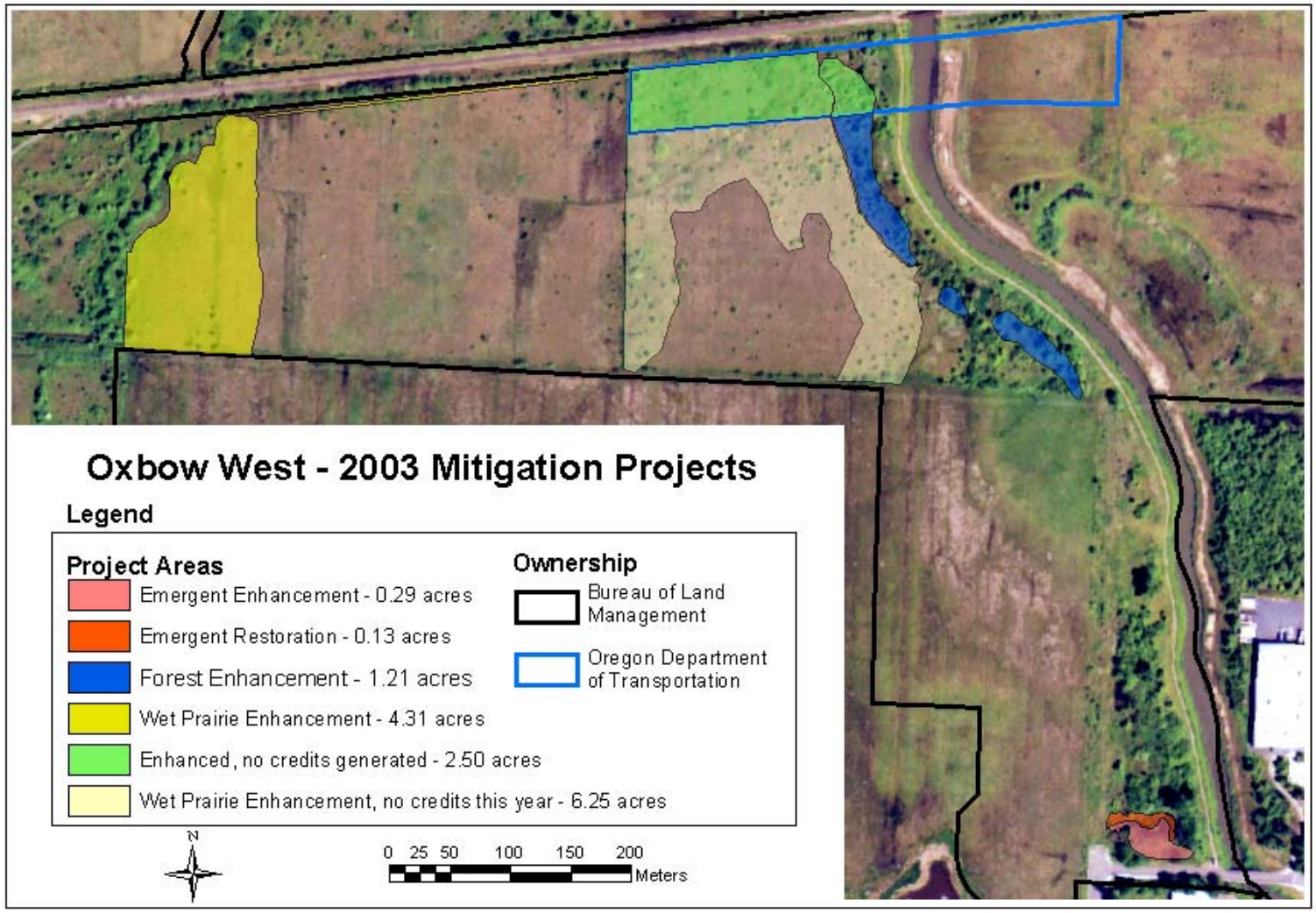


Figure 12.1. Oxbow West – 2003 Mitigation Projects Site Map. The map shows the enhancement and restoration areas labeled with their acreages. No credits will be generated from enhancement completed on land owned by the Oregon Department of Transportation. The wet prairie enhancement of 6.25 acres needs follow-up treatment in 2004—it will go online next year.

B. 2003 Monitoring Summary

Four sections of the Oxbow West Unit received management in the fall of 2003; the western prairie enhancement, eastern prairie enhancement, eastern forest enhancement, and the southern panhandle restoration and enhancement. The eastern forest was sampled and then thinned. Prior to thinning, the density of the forest was 0.85 trees per square meter. The western prairie was mowed to remove the ash trees that were invading the prairie. Photos were taken of the area before clearing occurred. The eastern prairie was also mowed to remove many native and non-native trees and shrubs that had invaded the prairie. Pre-treatment shrub monitoring revealed that approximately 20% of the prairie was covered by shrubs. A census of the trees in the eastern prairie was also completed before the woody vegetation was removed. Of the 2,646 trees recorded, most (989) were between 1 m and 2 m tall, and of those, 879 were either *Crataegus monogyna* x *suksdorfii* or *Crataegus suksdorfii*.

1. 2003 Management Actions

Western Wet Prairie Enhancement:

Ash trees that were colonizing the wet prairie were removed with a mower or chainsaw.

Eastern Wet Prairie Enhancement:

1. Ash trees and non-native Hawthorn and fruit trees were removed with a mower, chainsaw, or were removed with less invasive methods if rare plants were in the vicinity.
2. Maintenance crews solarized patches of reed canarygrass.
3. Large patches of Himalayan blackberry (*Rubus armeniacus*) were mowed.

Forest Enhancement:

Young ash trees, large female ash trees, and non-native Hawthorn and fruit trees were removed using a mower, chainsaw, or with less invasive methods if rare plants were in the vicinity.

Emergent Restoration:

Fill piles and reed canarygrass were removed from the emergent area. The site was then seeded with an emergent seed mix.

Emergent Enhancement:

Reed canarygrass was removed from the emergent area. The site was then seeded with an emergent seed mix.

2. Management Actions for 2004

Western Wet Prairie Enhancement:

The suckers of ash trees removed in 2003 will be mowed.

Eastern Wet Prairie Enhancement:

1. The suckers of trees removed in 2003 will be weedwacked or mowed.
2. Maintenance crews will continue to solarize additional patches of reed canarygrass.
3. Patches of reed canarygrass that were solarized in 2003 will be hand weeded or retreated with shadecloth if necessary.
4. Weedwack the regrowth of Armenia blackberry that was mowed in 2003.

Forest Enhancement:

The suckers of trees removed in 2003 will be weedwacked.

Emergent Restoration:

Hand weed exotics from the restoration.

Emergent Enhancement:

Hand weed exotics from the enhancement.

Table 12.2. Progress of the Oxbow West Panhandle Unit Restoration and Enhancement towards meeting the MOA vegetation standards. The most recent data for each section are compared to their relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MOA Vegetation Standards	Restoration	Goal Met?
Site status in the monitoring period	Year 0 of 5	N/A
Most recent quantitative data collected in year:	N/A	N/A
50% native **cover** after 2 years	2005	N/A
70% native **cover** after 5 years	2008	N/A
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2008	N/A
70% of the planted species shall be alive and present at the end of the five year monitoring period	2008	N/A
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2008	N/A
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2008	N/A

Table 12.3. Progress of the Oxbow West Unit East and West prairie enhancements, as well as, the forest enhancement towards meeting the vegetation standards. The most recent data for the enhancement are compared to their relevant vegetation standards from the MIP. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'LI' refers to line-intercept cover data collection.

Site Characteristics and MIP Vegetation Standards	East Prairie Enhancement	Goal Met?	West Prairie Enhancement	Goal Met?
Site status in the monitoring period	Year -1 of 5	N/A	Year 0 of 5	N/A
Most recent quantitative data collected in:	2003	N/A	Only qualitative data will be collected	N/A
60% reduction of total shrub cover after 5 years	LI = 2009	N/A	N/A	N/A
70% reduction of tree density after 5 years	Census 2009	N/A	Photopoints 2008	N/A

Table 12.4. Progress of the Oxbow West Unit Forest Enhancement towards meeting the vegetation standard. The most recent data for the enhancement are compared to their relevant vegetation standard. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MIP Vegetation Standards	Enhancement Area	Goal Met?
Site status in the monitoring period	Year 0 of 5	N/A
Most recent quantitative data collected in:	2003	N/A
50% reduction of tree density after 5 years	2008	N/A

C. Monitoring Results

1. Hydrology

a) *Methods*

The extent of standing water and saturated soil will be estimated and mapped during site visits in early spring beginning in 2004.

b) *Results*

N/A

2. Vegetation

A species list was compiled for the entire site and can be viewed in Appendix B.

a) *Methods Forest Enhancement Tree Density Sampling*

A survey of tree density in the eastern forest was done on August 15th and 18th of 2003. The monitoring crew sampled 47 1m x 14m plots along a 284m baseline that ran north to south through the forested edge. Within each plot, all trees were recorded by height class (1-2m, 2-3m, 3-4m, and > 4m) and species.

b) *Results Forest Enhancement Results of Tree Density Sampling:*

The density of trees per plot was 11.87 ± 2.22 trees. See Figure 12.2 for the average number of trees per plot by height class and species. *Fraxinus latifolia* (4.06 ± 1.88), *Crataegus suksdorfii* (3.38 ± 0.93) and the hybrid *Crataegus monogyna* x *suksdorfii* (2.53 ± .0.87) made up the majority of the trees within the enhancement area.

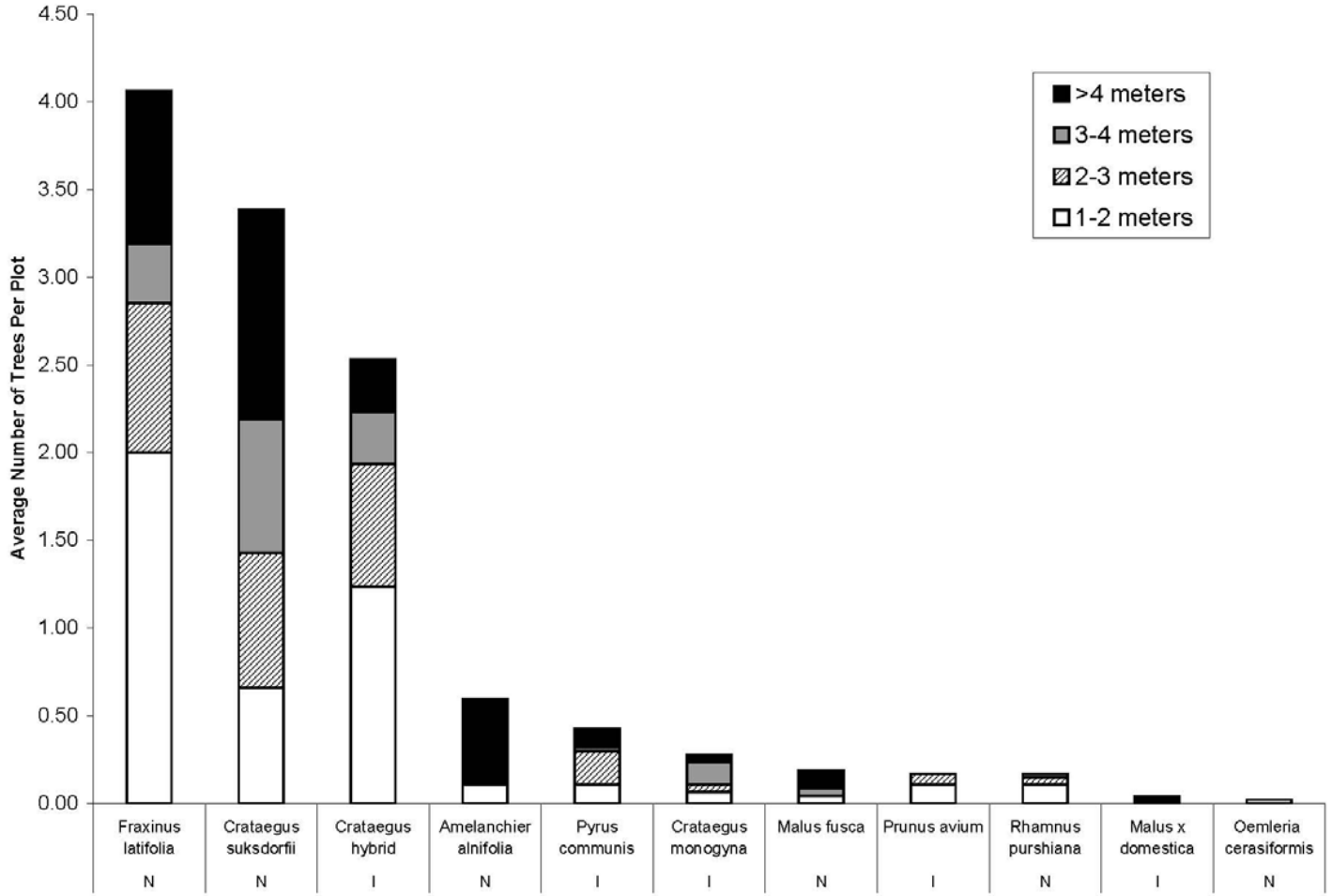


Figure 12.2. Density of Trees in the Eastern Forest Enhancement Area of the Oxbow West Unit. The average number of trees per plot is graphed by separating the species by 4 height classes (1-2 meters, 2-3 meters, 3-4 meters, and > 4 meters).

c) *Eastern Prairie Methods*
Line-intercept data were collected from 20 transects on August 19th, 21st, 22nd, 23rd, and 26th in a 100 x 100 m macroplot. A census of all the trees in the same macroplot was also done on August 12th and 13th.

d) *Results of the Eastern Prairie Line-intercept (Trees and Shrub Cover) Sampling*
Trees and shrubs cover 19.66% (± 1.64%) of the macroplot in the eastern prairie (Table 12.5). The majority of the cover is from the hybrid *Crataegus monogyna x suksdorfii* with a percent cover of 6.29% (± 1.64%). The native *Crataegus suksdorfii* has the second highest cover value at 5.21% (± 1.88%). The remaining 15 species all have less that 2% cover each. Species present in the eastern prairie, but without a cover value of greater that 1% include *Rhamnus purshianus, Crateagus monogyna, Amelanchier alnifolia, Toxicodendron diversiloba, Spirea douglasii, Rubus laciniatus, Malus fusca, Physocarpus capitatus, Pinus ponderosa, Rosa eglanteria,* and *Rosa multiflora*.

Table 12.5. Percent Cover of Shrub with greater than 1% cover in the Oxbow West Prairie Enhancement in 2003. The table includes all shrub species with a percent cover of > 1% found in the Oxbow West Prairie Enhancement in 2003 (prior to woody vegetation removal). The mean percent cover of each species, with a 90% confidence interval, is listed. The origin of each species is also noted. Below the species level information, the total shrub percent cover, total native shrub percent cover, and total non-native shrub percent cover are included with 90% confidence intervals.

Origin	Species	Mean	90% CI
I	*Crataegus monogyna x suksdorfii*	6.29%	± 1.64%
N	*Crataegus suksdorfii*	5.21%	± 1.88%
I	*Pyrus communis*	1.94%	± 0.69%
N	*Rosa nutkana*	1.70%	± 1.14%
I	*Rubus armeniacus*	1.26%	± 0.40%
N	*Fraxinus latifolia*	1.09%	± 0.71%
	Total Shrub Cover	19.66%	± 3.65%
	Native	9.18%	± 2.51%
	Introduced	10.48%	± 1.76%

e) *Eastern Prairie Tree Census Results*
Within the 100 m x 100 m macroplot, 2,646 trees were found (Table 12.6). This is a density of 0.26 trees/m^2. The majority were *Crataegus monogyna x suksdorfii* between 1 and 2 m tall (539), followed by *Crataegus suksdorfii* greater that 4 m tall (418). The ratio of native to non-native trees was roughly 55:45.

Table 12.6. Tree Census Results from the Oxbow West Eastern Prairie Enhancement in 2003. The table includes all tree species found in the Oxbow West Eastern Prairie Enhancement in 2003 (prior to woody vegetation removal), whether the trees are native or non-native in origin, and the totals by height class and species.

		Height Class				
Origin	**Species**	**1-2m**	**2-3m**	**3-4m**	**>4m**	**Total**
I	*Crataegus monogyna x suksdorfii*	539	255	152	91	1037
I	*Crataegus monogyna*	5	1	1	1	8
N	*Crataegus suksdorfii*	340	380	266	418	1404
N	*Fraxinus latifolia*	6	15	4	13	38
N	*Malus fusca*	0	4	8	1	13
N	*Pinus ponderosa*	1	0	0	0	0
I	*Pyrus communis*	90	27	6	9	132
I	*Pyrus malus*	0	2	0	2	4
N	*Rhamnus purshianus*	8	0	0	1	9
	Native	355	399	278	433	1464
	Introduced	634	285	159	103	1181
	Totals	989	684	437	536	2646

Chapter 13: Stewart Pond, Grimes Pond, and Teal Slough Unit

A. Site Description

1. Size: 30 acres

2. Ownership: BLM

3. Site Timeline: **Table 13.1**

Section	Year of Construction	Acreage	Monitoring Period
Stewart Pond Extension	1995	1.80	1996-2006*
Ash woodland Expansion	1995	0.25	1996-2006*
Stewart Pond , Grimes Pond and Teal Slough Enhancement	1996	5.21	1996-2006*

*The monitoring period has been extended to allow for remedial action.

4. Location

The Stewart Pond, Grimes Pond, Teal Slough Unit of the Stewart Management Area is located along the western slope of Stewart Knoll, north of Stewart Road and south of the A3 Channel in west Eugene, Or.

5. Site History

This site has a variety of past land uses. The area of Stewart Pond was once used as part of a dairy farm. The water features in the north, Grimes Pond and Teal Slough, were created when gravel was excavated.

6. Focus of Prescriptions

In general, prescriptions applied to Stewart Pond, Grimes Pond and Teal Slough sought to integrate existing wetland areas located across the breath of the site. This objective was met through restoration, enhancement, and creation of emergent wetland. Measures to enhance wildlife habitat included placing logs in the ponds and planting dead trees along the fringe of the upland and wetland boundary to offer snags for birds to perch and nest in. Prescriptions were completed in 1995.

7. Site-Specific Management Goals

1. Expand the existing emergent wetland.
2. Eliminate or reduce concentrations of reed canarygrass at the site.
3. Increase the extent and suitability of habitat available for migratory birds and other wetland wildlife species.
4. Promote wildlife viewing and environmental education opportunities.
5. Expand the existing riparian woodland along the fringes of Teal Slough.
6. Enhance habitat for the Western pond turtle.

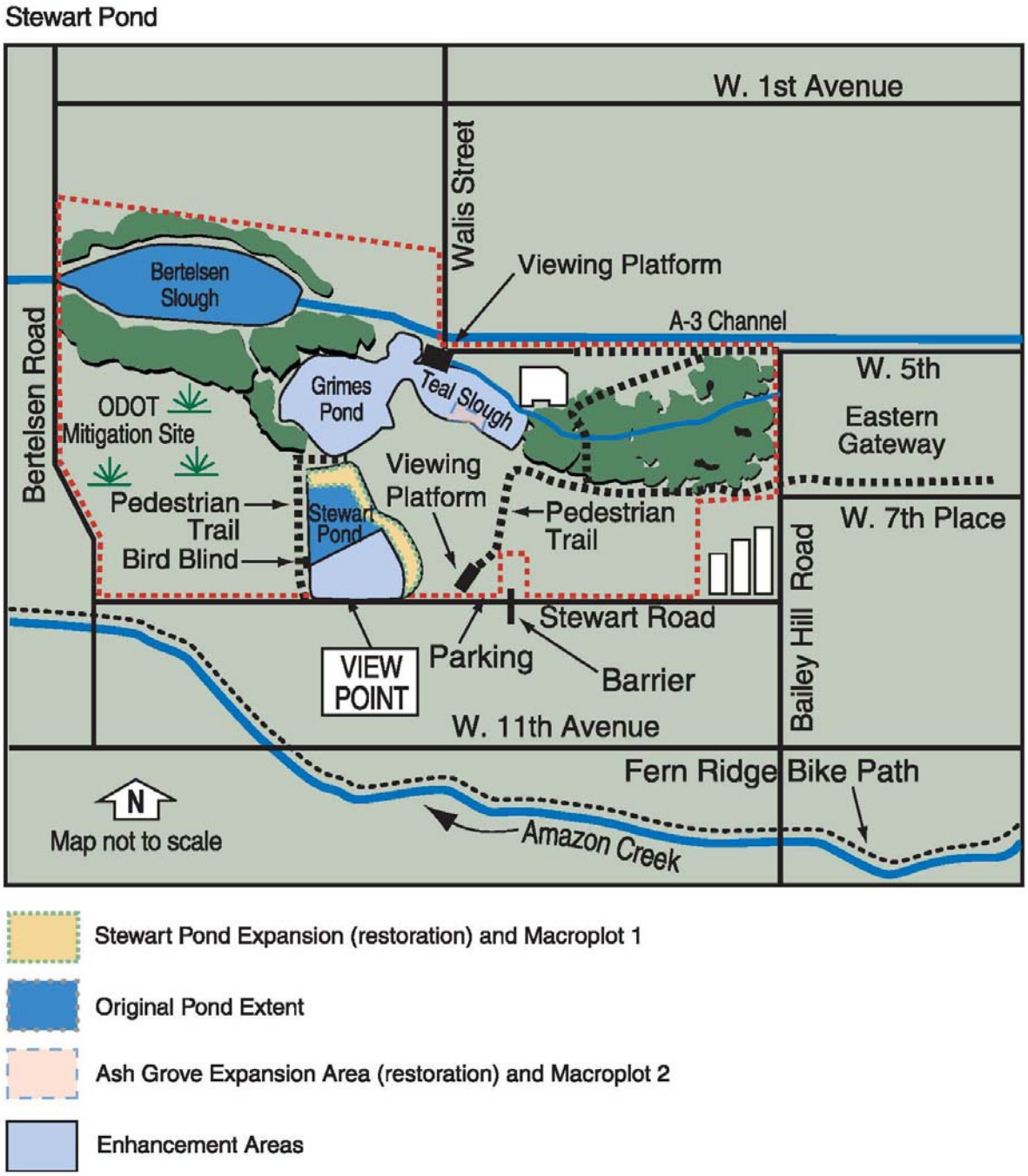


Figure 13.1. Stewart Pond, Grimes Pond, and Teal Slough Site Map. The original pond, the pond expansion, the slough expansion, and the enhancement areas are labeled with their associated macroplots.

B. 2003 Monitoring Summary

The pond and woodland expansion areas continue to show hydrology sufficient for the maintenance of its hydric soils and hydrophytic vegetation. The pond expansion restoration met all of the MOA and MIP vegetation goals for native species cover and species richness, as well as, the requirements for seed survival. The woodland expansion enhancement also met the native species cover goal and species diversity goal, but not its forest cover goal. The goal was to have 2 woody species with a combined cover of 25%. *Salix* spp. and *Populus trichocarpa* cover combined was 7.7%. Given a few more years, this site will meet the 25% tree cover goal.

Areas of Grimes Pond, Teal Slough and most of the original area covered by Stewart Pond are enhancements. Some minor work was done in 1996 to fulfill the credits received from these areas; however, additional work will be needed to meet mitigation bank vegetation success standards. In 2004 these areas will be treated by tilling them twice to remove the reed canarygrass. These areas will then be seeded with and emergent seed mix in the fall of 2005. Additionally, the deeper areas of Grimes Pond and Teal Slough will be planted with cottonwood and willow trees.

All mitigation areas of the Stewart Pond Complex will receive quantitative vegetation monitoring in 2005 to assess the site's success in meeting the vegetation standards.

1. 2003 Management Actions

Original Pond:

1. The interior was mowed to prevent the seed set of the reed canarygrass.
2. An area in the northwest was tilled to potentially provide habitat for shorebirds.

Pond Expansion:

No maintenance actions were taken.

2. Management Actions for 2004

Original Pond:

1. The pond will be mowed and tilled to remove the reed canarygrass.
2. The pond will be seeded with an emergent species planting mix.

Pond Expansion:

The area will be hand weeded to remove reed canarygrass and pennyroyal.

Grimes Pond and Teal Slough:

1. The slough and pond will be mowed and tilled to remove the reed canarygrass.
2. The slough pond will be seeded with an emergent species planting mix.
3. The deeper areas of the slough will be planted with cottonwood trees and willows.

Table 13.2. Progress of the Stewart Pond Expansion Restoration towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Vegetation Standard in MOA	Stewart Pond Expansion Restoration	Goal Met?
Site status in the monitoring period	1996-2002, extended to 2003	N/A
Most recent quantitative data collected in:	PI - 2002 NF - 2003	N/A
70% native **cover** after 5 years	75%	Yes
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	75%	Yes
70% of the planted species shall be alive and present at the end of the five year monitoring period	87%	Yes
Vernal Pool/Emergent: min 5 native species occurring at 10**% frequency** rate or greater	14	Yes

Table 13.3. Progress of the Stewart Pond Woodland Expansion Enhancement towards meeting the vegetation standards in the MIP. The most recent data for each phase is compared to its relevant vegetation standards. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Vegetation Standard	Woodland Expansion Enhancement	Goal Met?
Site status in the monitoring period	1996-2002, extended to 2003	N/A
Most recent quantitative data collected in:	PI – 2002 NF - 2003	N/A
70% native **cover** after 5 years	81%	Yes
Vernal Pool/Emergent: min 5 native species occurring at 10**% frequency** rate or greater	9	Yes
Forest: 2 woody species with combined cover of 25%	7.7%	No

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits, the first in early spring and the second in late fall. Water depths were measured monthly during the wet season at 1 staff gauge.

b) Results

Stewart Pond and its associated enhancements and restorations continue to exhibit hydrology sufficient for the development of hydric soils and hydrophytic vegetation. Ninety percent of the expansion area was under standing water on April 15th of 2003 and the remaining 10% of the site had soils that were visible saturated to the surface.

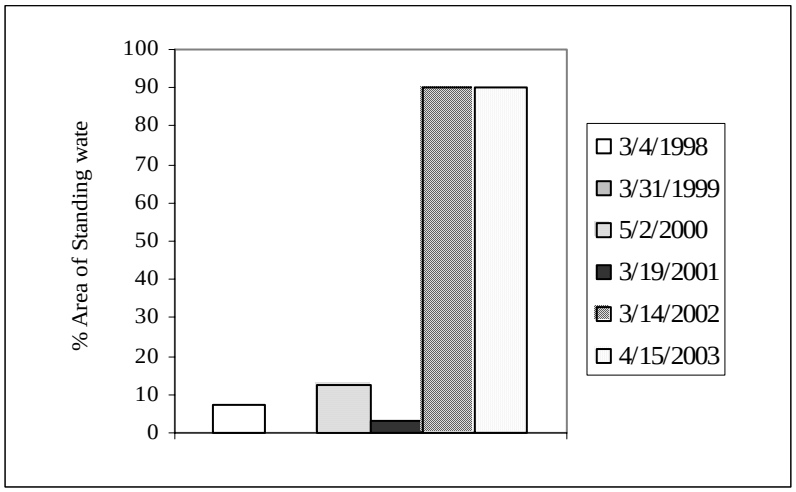


Figure 13.2. Spring standing water in the expansion of Stewart Pond. Percentage of the pond expansion with standing water in the early spring over the history of the restoration.

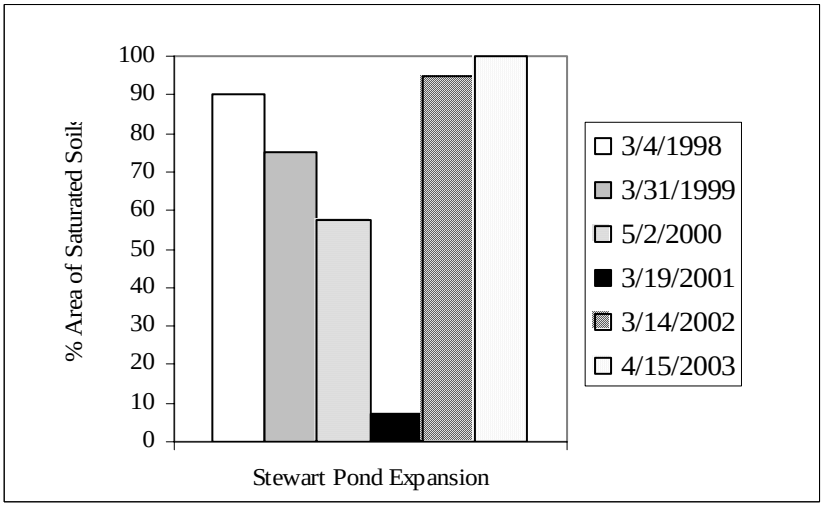


Figure 13.3. Spring saturated soils in expansion of Stewart Pond. Percentage of the Stewart Pond expansion with saturated soils in the early spring over the history of the restoration.

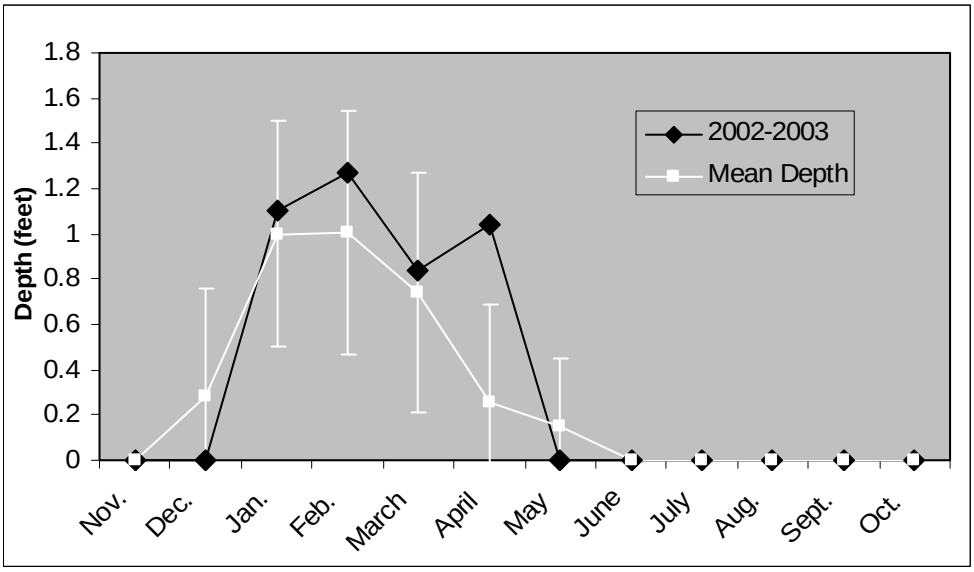


Figure 13.4. Inundation levels in the pond expansion during 2002-2003 compared to the mean and standard deviation of depths between 1998 and 2003. Depth of inundation throughout the year in the pond expansion area over 2002-2003. The mean and standard deviation calculated from depths observed between 1998 and 2003 are also graphed for comparison.

2. Vegetation

a) Methods

Point-intercept data were collected for the pond expansion and the ash swale extension on June 10th and 11th of 2002. A total of 238 point were collected in the pond expansion, while only 39 were collected in the ash swale expansion because it is quite small (¼ of an acre). Even though these data were collected in 2002, they are included in the 2003 Annual Report so that all data used to assess the site's success at meeting the mitigation bank standards is in one report.

Nested frequency data were collected on July 31st and August 1st, 4th and 5th. A total of 124 plots were sampled in the expansion area and 33 were sampled in the expanded riparian woodland.

The general species list for the site was also updated and can be viewed in Appendix B.

b) Results

Point-intercept Sampling Results:

Both the Stewart Pond Expansion and the Ash Swale Expansion restorations met the 5th year performance standard of 70% cover of native vegetation. The relative percent cover of the native species in the pond expansion is 75%, while the relative percent cover of natives in the ash swale expansion is 80%. There is still a large proportion of introduced species covering in both areas (50% in the pond expansion and 35% in the swale expansion). *Agrostis alba/tenuis* and *Mentha pulegium* contribute heavily to the total cover of exotic species in both macroplots, but in contrast to other restorations, hand weeding appears to keep them from dominating the site.

Another vegetative performance standard states that at least 70% of the native species planted are to be present the final year of monitoring. The pond expansion exceeds this standard with 82% of the species

planted being present. Only 41% of the species planted in the ash swale expansion were present this summer; however, many of the species planted were not appropriate for the hydrology of the area. Also, 33 native species were planted, and while 28 native species were present in the macroplot, the majority of these species colonized the site naturally.

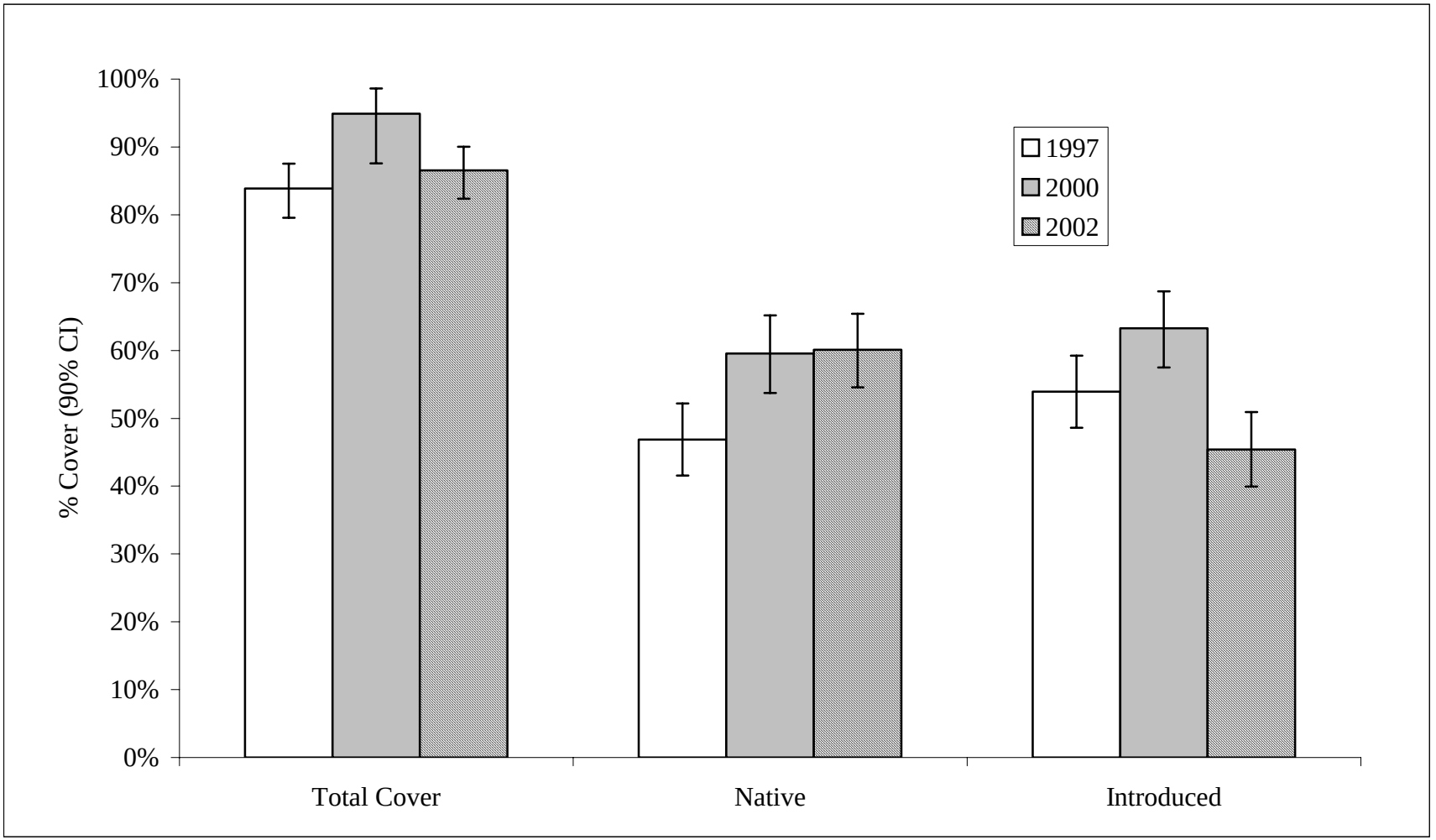


Figure 13.5. Percent cover of ground cover guilds in the Stewart Pond Expansion. The total percent cover of all vegetation, native species, and introduced species in the Stewart Pond Extension.

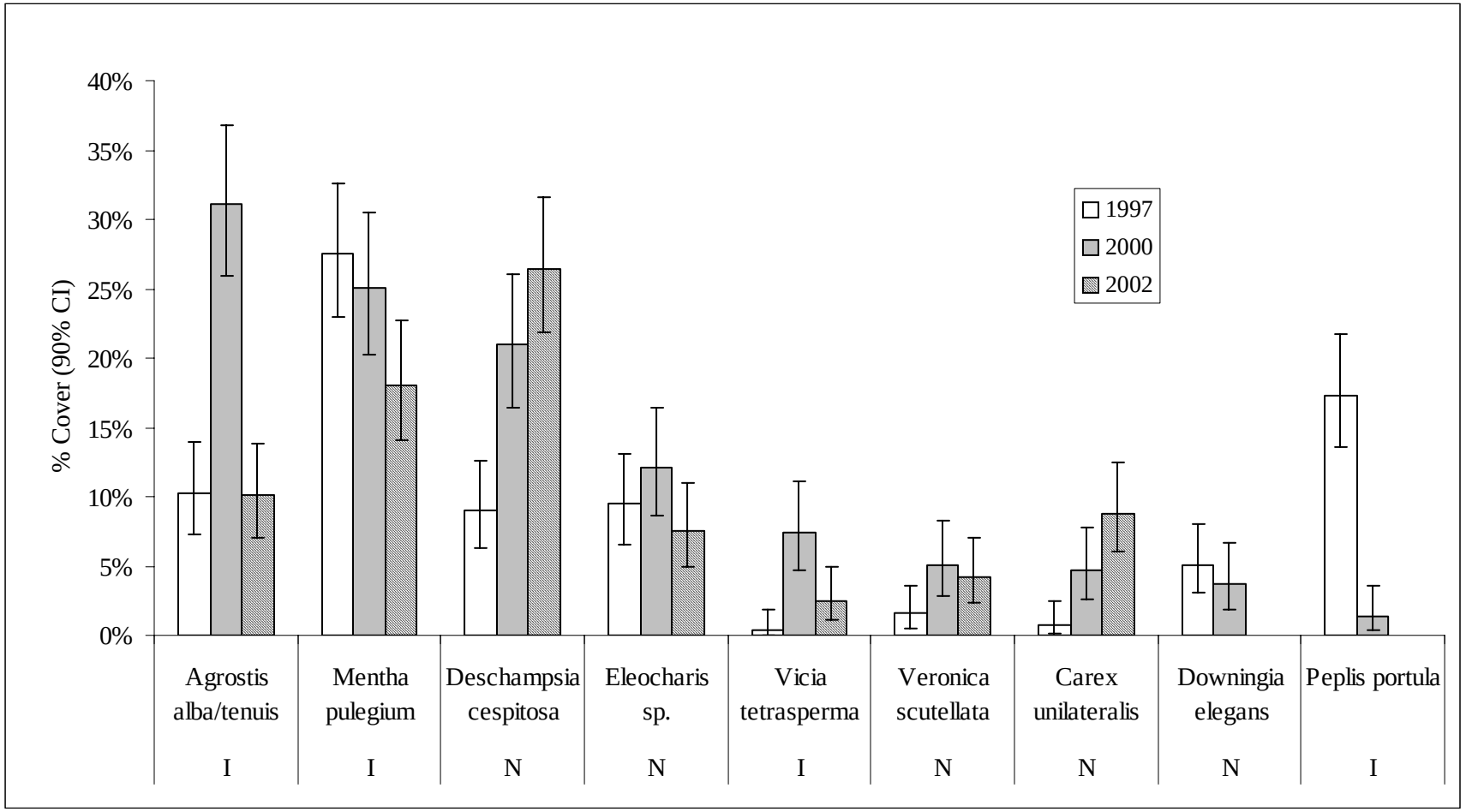


Figure 13.6. Species in the Stewart Pond Expansion with > 1% cover. All species in 2002 with greater than one percent cover are graphed for the pond extension. Each species is also labeled with either and 'N' or an 'I' to indicate whether it is a native or introduced species.

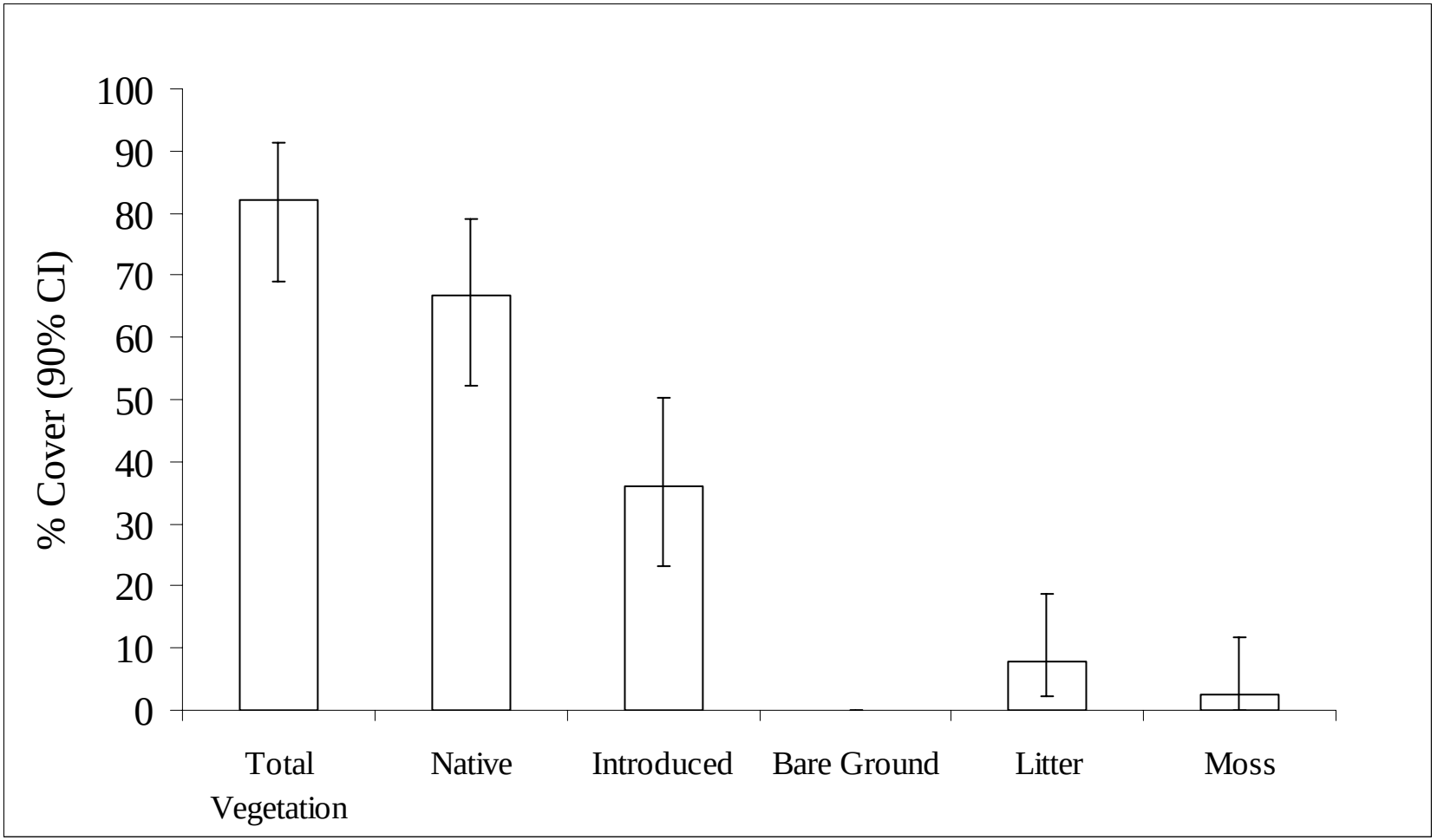


Figure 13.7. Percent cover of ground cover guilds in the Stewart Pond ash swale expansion. The total percent cover of all vegetation, native species, introduced species, bare ground, litter, and moss are reported for the Stewart Pond ash swale extension.

Nested Frequency Sampling Results:
Stewart Pond Expansion Restoration met all mitigation bank nested frequency standards. Of the species with greater than 50% frequency, 75% were native (Table 13.4). Standards require 5 species with a frequency of greater than 10% be vernal pool and/or emergent—the restoration had 14.

Stewart Pond Ash Swale Expansion area did not meet the MIP standards for native diversity. Of the species with greater than 50% frequency, 75% were not native. Three species had a frequency of greater than 50% and one was native. The other standard requires that 5 of the species with a frequency of greater than 10% be native vernal pool or emergent species. The restoration met this criterion with 9 qualifying species. (Table 13.5)

Table 13.4. Species Present with Greater than 10% Frequency in the Stewart Pond Expansion Restoration. All species present with > 10% frequency in the Stewart Pond Restoration Expansion are listed with their origin and 90% confidence limits. Habitat information is also listed for native species where 'VP/E' represents vernal pool and emergent habitats and 'WP' corresponds to wet prairie habitat.

Species	Origin	Frequency	Lower CI	Upper CI	Habitat
Mentha pulegium	I	74.19	66.93	80.57	
Eleocharis palustris	N	72.58	65.22	79.11	VP/E
Deschampsia cespitosa	N	65.32	57.67	72.42	WP
Carex unilateralis	N	58.06	50.29	65.55	VP/E
Madia glomerata	N	39.52	32.14	47.27	VP/E
Juncus patens	N	25.00	18.71	32.21	VP/E
Veronica scutellata	N	22.58	16.55	29.62	VP/E
Juncus tenuis	N	21.77	15.84	28.75	VP/E & WP
Phalaris arundinacea	I	21.77	15.84	28.75	
Lactuca sp.	I	21.77	15.84	28.75	
Lotus unifoliatus	N	20.97	15.13	27.88	WP
Downingia spp.	N	20.16	14.42	27.01	VP/E
Agrostis exarata	I	13.71	8.93	19.85	VP/E
Juncus effuses	N	12.90	8.26	18.94	VP/E
Alopecurus pratensis	I	12.90	8.26	18.94	
Bidens frondosa	N	12.10	7.61	18.01	VP/E
Agrostis exarata	N	11.29	6.96	17.09	VP/E
Epilobium densiflora	N	11.29	6.96	17.09	VP/E & WP
Juncus ensifolius	N	11.29	6.96	17.09	VP/E
Juncus bolanderi	N	10.48	6.31	16.15	VP/E

Table 13.5. Species Present with Greater than 10% Frequency in the Stewart Pond Ash Swale Expansion Restoration. All species present with > 10% frequency in the Stewart Pond Ash Swale Expansion are listed with their origin and 90% confidence limits. Habitat information is also listed for native species where 'VP/E' represents vernal pool and emergent habitats and 'WP' corresponds to wet prairie habitat.

Species	Origin	Frequency	Lower CI	Upper CI	Habitat
Mentha pulegium	I	72.73	15.49	12.24	
Agrostis spp.	I	69.70	15.65	12.85	
Veronica scutellata	N	57.58	15.72	14.65	VP/E
Juncus patens	N	45.45	14.96	15.61	VP/E
Juncus effusus	N	42.42	14.65	15.72	VP/E
Beckmannia syzigachne	N	39.39	14.28	15.78	VP/E
Phalaris arundinacea	I	39.39	14.28	15.78	
Eleocharis palustris	N	39.39	14.28	15.78	VP/E
Carex obnupta	N	36.36	13.86	15.79	VP/E
Deschampsia cespitosa	N	33.33	13.39	15.75	WP
Epilobium ciliatum	N	33.33	13.39	15.75	WP
Bidens frondosa	N	33.33	13.39	15.75	VP/E
Epilobium densiflorum	N	27.27	12.24	15.49	VP/E
Lythrum portula	I	21.21	10.81	14.96	
Alopecurus pratensis	I	18.18	9.95	14.58	
Dipsacus fullonum	I	18.18	9.95	14.58	
Holcus lanatus	I	18.18	9.95	14.58	
Populus trichocarpa	N	18.18	9.95	14.58	VP/E
Leontodon taraxacoides	I	15.15	8.99	14.10	
Cirsium vulgare	I	15.15	8.99	14.10	
Lactuca seriola	I	15.15	8.99	14.10	
Rubus armeniacus	I	12.12	7.87	13.50	

3. Wildlife Utilization

The Stewart and Grimes Ponds/ Teal Slough complex of wetlands continues to be the most utilized by wildlife of all the mitigation bank sites. While waterfowl are most common, hawks, coots, shorebirds, gulls and swallows, bufflehead, turkey vultures, ring-necked pheasants, greater yellowlegs, common snipe, belted kingfishers, violet-green swallows, scrub jays, American crows, and red-winged blackbirds have all been seen at the site. However, with the proliferation of reed canarygrass in the area of the main pond, the site has become less valuable for shorebirds. Actions are currently being taken to regain the site's utility for these species. (For a more complete list of species that use the site see the 1998 Annual Report.)

Chapter 14: Turtle Swale Unit

A. Site Description

1. Size: 60.5 acres

2. Ownership: BLM

3. *Site Timeline:* **Table 14.1**

Section	Construction Year	Acreage	Monitoring Period
Phase 1	2001	10.07	2002-2006
Phase 2	2002	11.62	2003-2007
Phase 3	To be determined	To be determined	To be determined

4. Location

Turtle Swale is Unit 1 of the 398 acres of the Lower Amazon Wetland Restoration and Enhancement Project. It occupies the area south of Royal Avenue between the Amazon Diversion Channel and the Amazon Creek in west Eugene, OR.

5. Site History

There have been a variety of past land uses on this site. The eastern tax lot was cultivated for ryegrass. The western tax lot below Turtle Swale appears to have been heavily cultivated. Portions of the site north of the swale were filled with a variety of urban debris and approximately 32,000 cubic yards of fill material. The remainder of this section may have been grazed, but appears not to have been tilled.

6. Focus of Prescriptions

The overall goal for the Turtle Swale Unit is to protect and enhance higher quality areas and their associated populations of rare species, while restoring the highly degraded areas that were historically wet prairie and emergent communities. This will be done by removing existing fill piles, the adjacent channel levees, colonies of reed canarygrass, and restoring the historic swale that runs east to west across the site.

7. Site-Specific Management Goals

1. Restore the emergent areas by eliminating or reducing concentrations of reed canarygrass.
2. Restore the historic swale running east to west across the site for western pond turtle habitat.
3. Protect and enhance the populations of rare plant species on the site. These species include *Aster curtus*, *Lupinus sulphureus* var. *kincaidii*, and *Asclepias fasicularis*.

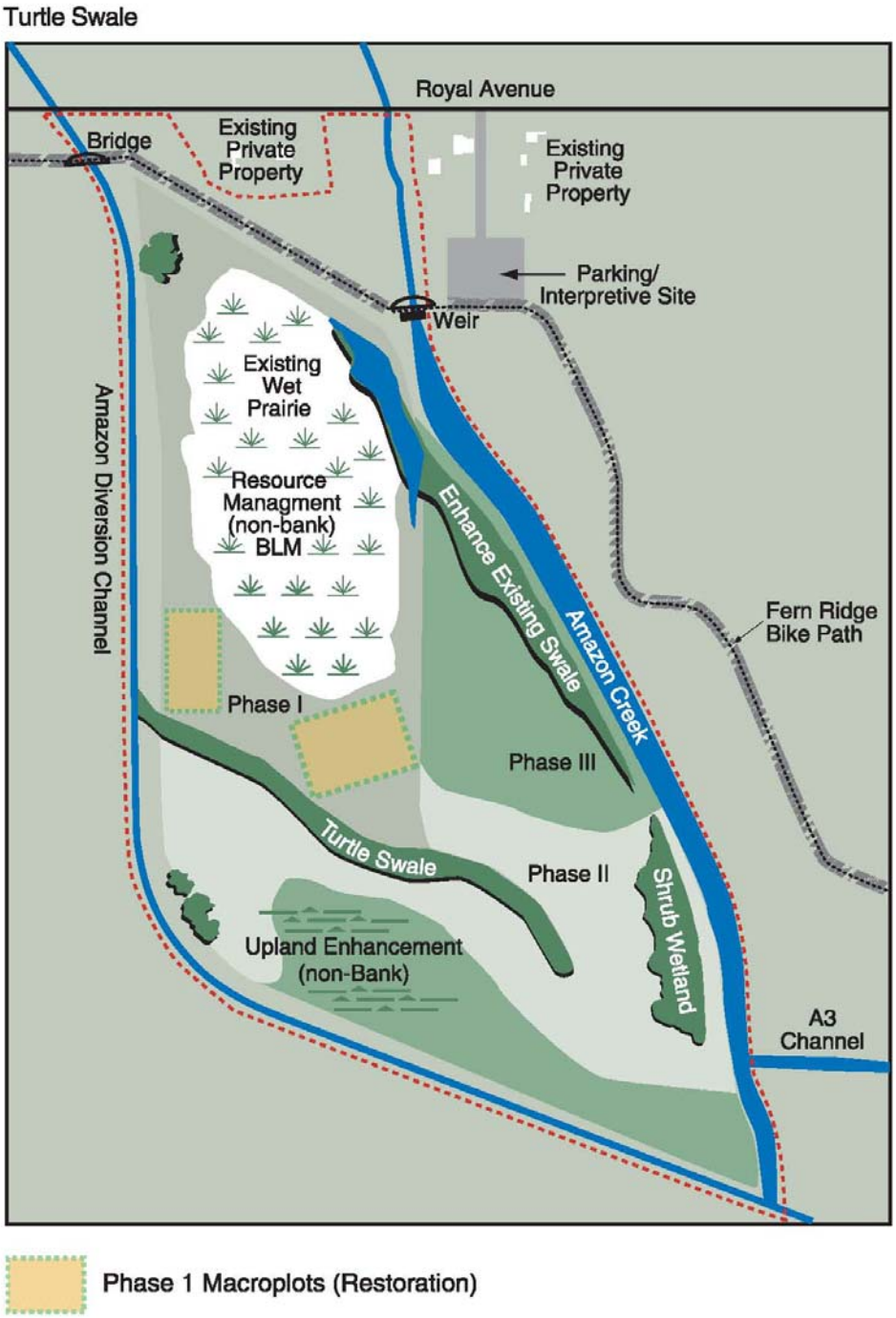


Figure 14.1. Turtle Swale Site Map. The phases, Enhancement areas and pre-existing wet prairie areas are labeled. Community vegetation monitoring will begin in 2003. Macroplots created for this purpose will be added to the map next year.

B. 2003 Monitoring Summary

Turtle Swale Phase 1 is meeting vegetation and hydrology standards. It met the 2nd-year vegetation standard of 50% native cover with 97% and 91% native cover in 2 different macroplots. Additionally, the water table was within 4.5 inches of the soil surface well into the growing season.

Phase 2 appears to be progressing towards meeting hydrology, but not mitigation bank vegetation standards. Approximately 90% of the soil was saturated to the surface in mid-April. Soil pits will be dug in the spring of 2004 to confirm wetland hydrology. Of the 81 species seeded, 40 were observed. However, 19 species of those not observed were emergent species and there is little to no emergent habitat in Phase 2. Despite the large number of species recorded, the overall plant cover of Phase 2 was sparse. The site was reseeded with a wet prairie/vernal pool mix using a no-till drill in the fall of 2003 to increase cover.

1. 2003 Management Actions

Phase 1:

1. Maintenance crews spent 14 days removing exotics from the restoration area. The target species included reed canarygrass, thistles, teasel, St. John's wort, pennyroyal, and non-native bentgrasses.
2. Plugs and bulbs of the following species were planted in October of 2003 in the quantities specified: 1) *Triteleia hyacinthina* (33 2-year old 'conetainers' sometimes with multiple bulbs), 2) *Perideridia oregana* (25 'conetainers' sometimes with multiple plants of 1-year old plants), 3) *Camassia quamash* var. *maxima* (5 trays of 1" cells—1-year old), 4) *Juncus bolanderi* (1.5 trays flats— 1-year old), 5) *Juncus ensifolius* (2 flats), 6) *Juncus patens* (1 flat), 7) *Brodiaea coronaria* (33 2-year old 'conetainers' sometimes with multiple bulbs), and 8) *Zigadenus venosus* var. *venosus* (33 2-year old 'conetainers' sometimes with multiple bulbs and 1 flat).

Phase 2:

1. Maintenance crews spent 24 days removing exotics from the restoration area. The main target species included St. John's wort, pennyroyal, and non-native bentgrasses.
2. Plugs and bulbs of the following species were planted in October of 2003 in the quantities specified: 1) *Triteleia hyacinthina* (66 1-year old 'conetainers' sometimes with multiple bulbs), 2) *Perideridia oregana* (25 'conetainers' sometimes with multiple plants of 1-year old plants), 3) *Camassia quamash* var. *maxima* (5 trays of 1" cells—1-year old), 4) *Allium amplectens* (33 1-year old 'conetainers' sometimes with multiple bulbs and 1 flat), 5) *Brodiaea coronaria* (66 1-year old 'conetainers' sometimes with multiple bulbs), and 6) *Zigadenus venosus* var. *venosus* (66 1-year old 'conetainers' sometimes with multiple bulbs and 1 flat).
3. The first seeding did not result in sufficient cover, so it was seeded again in the fall with a wet prairie and vernal pool seed mix using a no-till drill.

Remnant Prairies:

Phase 3 was mowed twice during the summer to reduce the spread of exotics into the restorations.

2. Management Actions for 2004

Phase 1:

1. Continue to remove reed canarygrass (*Phalaris arundinacea*), Harding grass (*Phalaris aquatica*), and Canada thistle (*Cirsium arvense*) present mainly along the eastern edge of Phase 1.
2. Continue to clip teasel (*Dipsacus fullonum*) heads, mainly located along the eastern edge of Phase 1, to prevent its spread.

Phase 2:

1. Both sides of the bank tops of Turtle Swale are very weedy, including large quantities of hairy cat's ear (*Hypochaeris glaba*) and Canada thistle (*Cirsium arvense*). Disk this area and follow-up with thermal treatment (possibly with *Sunburst*) to sterilize. Seed with highly aggressive wet prairie mix.
2. Continue to hand weed reed canary-grass (*Phalaris arundinacea*) that is coming up in small scattered pockets across the restoration area.
3. The upland prairie area along the southern edge of Phase 2 is weedy with a significant amount of blackberry. This area will be tilled, sterilized (possibly with the *Sunburst*) and seeded. This treatment will be done concurrently with the treatment of the Phase 3 area and the areas parallel to Turtle Swale. Remove blackberry crowns in conjunction with this work.
4. The eastern edge of this restoration area is weedy with geranium (G*eranium dissectum*), Canada thistle (*Cirsium arvense*), and teasel (*Dipsacus fullonum*). Continue to focus on weed control in this area. Mow this section of Phase 2 as early in the spring as equipment can access the site.
5. Remove barbed wire fencing lying on the ground along the east edge.
6. Weed pennyroyal area located between the channel and the milk weed population.
7. Overseed Phase 2 with a diverse wet prairie and vernal pool seed mix.

Phase 3:

The proposed restoration in this area is currently on hold. In the interim, the goal is to control the spread of seed from this phase into the restorations. Use the technique of disking, sterilizing using a thermal technique (possibly the Sunburst), and planting with a low diversity, highly aggressive wet prairie mix. If successful, this could be the beginning of the Phase III restoration, with additional species diversity added in following years.

Remnant Prairies (Non-mitigation Bank Areas):

Central Prairie Area

Continue to selectively remove woody vegetation from this area, focusing on exotics.

Amazon Creek ("A" Channel)

This area offers good Western pond turtle habitat, which could be improved on by minimizing woody vegetation along the banks and incorporating basking logs.

Remnant prairie (triangular area in southeast corner of site)

Remove pear and other exotic woody species and keep native trees and shrubs from expanding in this area.

Table 14.2. Progress of the Turtle Swale Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Vegetation Standard in MOA	Phase 1	Goal Met?	Phase 2	Goal Met?
Site status in the monitoring period	2002-2006	N/A	2003-2007	N/A
50% native **cover** after 2 years	MP 1 = 97% MP 2 = 91%	Yes	2004	TBD
70% native **cover** after 5 years	2006	TBD	2007	TBD

Vegetation Standard in MOA	Phase 1	Goal Met?	Phase 2	Goal Met?
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2006	TBD	2007	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2006	TBD	2007	TBD
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2006	TBD	2007	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2006	TBD	2007	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped for Phases 1 and 2 during a site visit in early spring. Staff gauges were installed in two locations in Phase 1 and monitoring of these gauges began in 2003. Hydrology monitoring for Phase 2 began in 2003 as well.

b) Results

The location and duration of saturated and inundated soils was relatively unchanged from 2002. On April 11 of 2003, 75% of Phase 1 had standing water and 100% of the site had saturated soils to the ground surface. Additionally, soil pits were dug in the sections of the site that were topographically higher that the majority of the restoration. The depth to the water table ranged from 4 to 4.5 inches. This indicates that the site has sufficient hydrology to promote the development of hydric soils and hydrophytic vegetation.

Phase 2

On April 11 of 2003, 25% of Phase 2 was inundated with small (<5m^2), shallow (<3" deep) vernal pools. Approximately 90% of the site's soil was saturated to the soil surface. These observations suggest that the restoration has sufficient hydrology to promote the development of hydric soils and hydrophytic vegetation. Soil pits will be dug in Phase 2 next spring (2004) to confirm this determination.

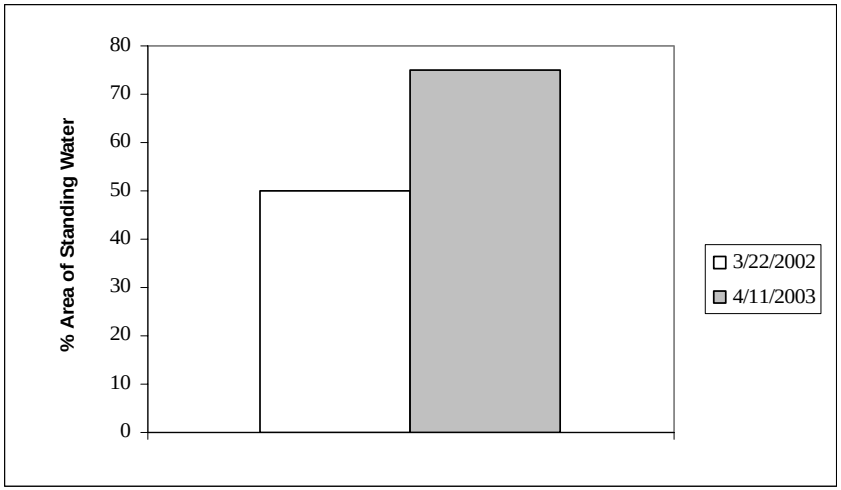


Figure 14.2. **Spring standing water in Phase 1 of the Turtle Swale Unit.** Percentage of Phase 1 with standing water in the late spring over the history of the restoration.

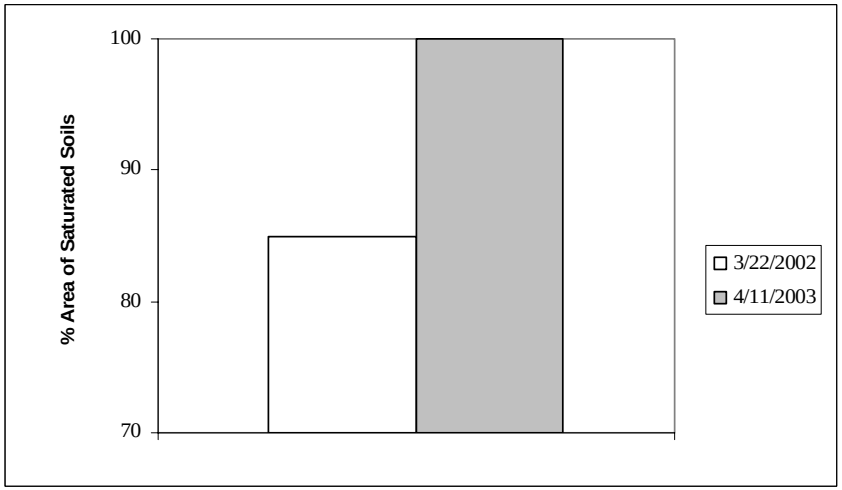


Figure 14.3. **Spring saturated soils in Phase 1 of the Turtle Swale Unit.** Percentage of the Phase 1 with saturated soils in the late spring over the history of the restoration.

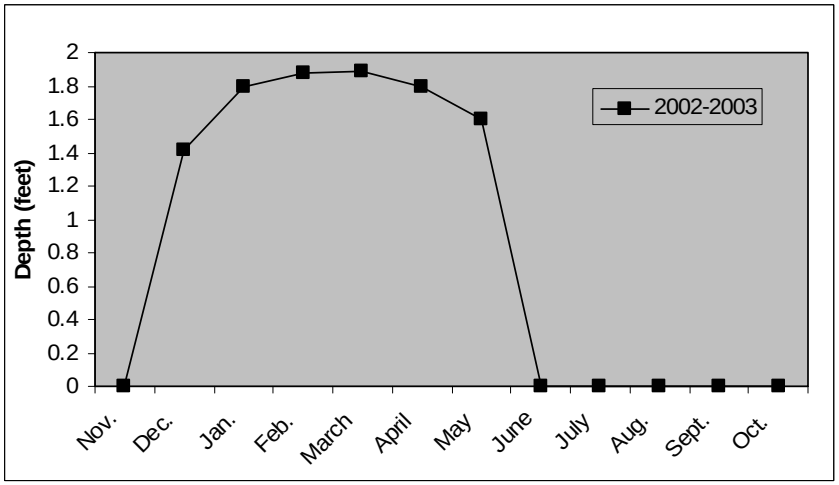


Figure 14.4. Turtle Swale Phase 1 inundation levels in the eastern section during 2002-2003. Depth of inundation throughout the year in the eastern section in 2001-2002.

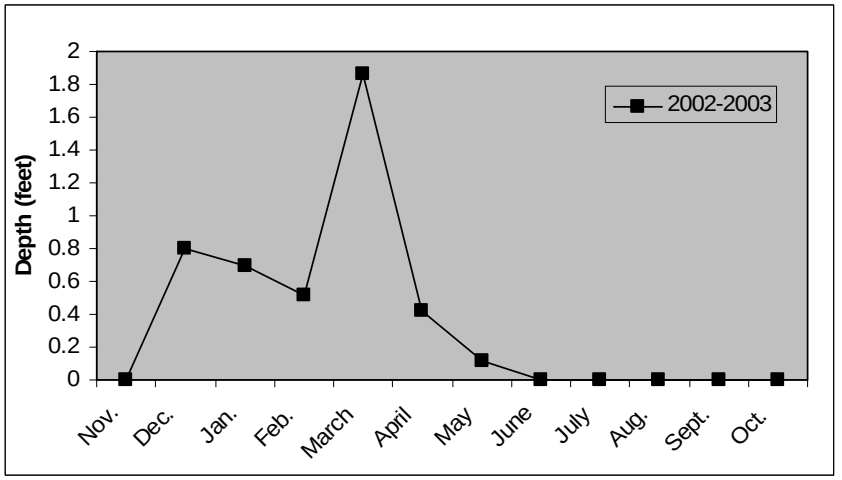


Figure 14.5. Turtle Swale Phase 1 inundation levels in the western section during 2002-2003. Depth of inundation throughout the year in the western in 2001-2003.

2. Vegetation

a) Methods

Point-intercept data were collected in two macroplots. Macroplot 1 was sampled on August 11th and 14th of 2003 for a total of 204 points. Macroplot 2 was sampled on August 14th and 15th of 2003 for a total of 209 points.

A seeding assessment for Phase 2 was completed on June 9, 2003. Each species seeded that was observed during the site visit was given a value of 'Dominant,' 'Common,' 'Uncommon,' or 'Trace.'

A general plant species list for each phase was also updated and can be viewed in Appendix B.

b) Results

Results of Phase 1 Point-intercept Cover Sampling:

Data from both Macroplots show that Phase 1 meets the 2nd-year vegetation standards of 50% native species cover (Figure 14.6 and 14.8). Of the total vegetation, Macroplot 1 is 97% native and Macroplot 91% native. Both macroplots are dominated by *Deschampsia cespitosa* (macroplot 1 = 25%, $20.07\% \leq \mu \leq 30.19\%$; macroplot 2 = 20.57%, $16.07\% \leq \mu \leq 25.71\%$). In macroplot 1, all species with greater than 1% cover are native (Figure 14.7). In macroplot 2, *Leontodon taraxacoides* ($1.58\% \leq \mu \leq 6.20\%$), and *Trifolium dubium* ($2.62\% \leq \mu \leq 7.98\%$) are the non-natives with greater than 1% percent cover (Figure 14.9).

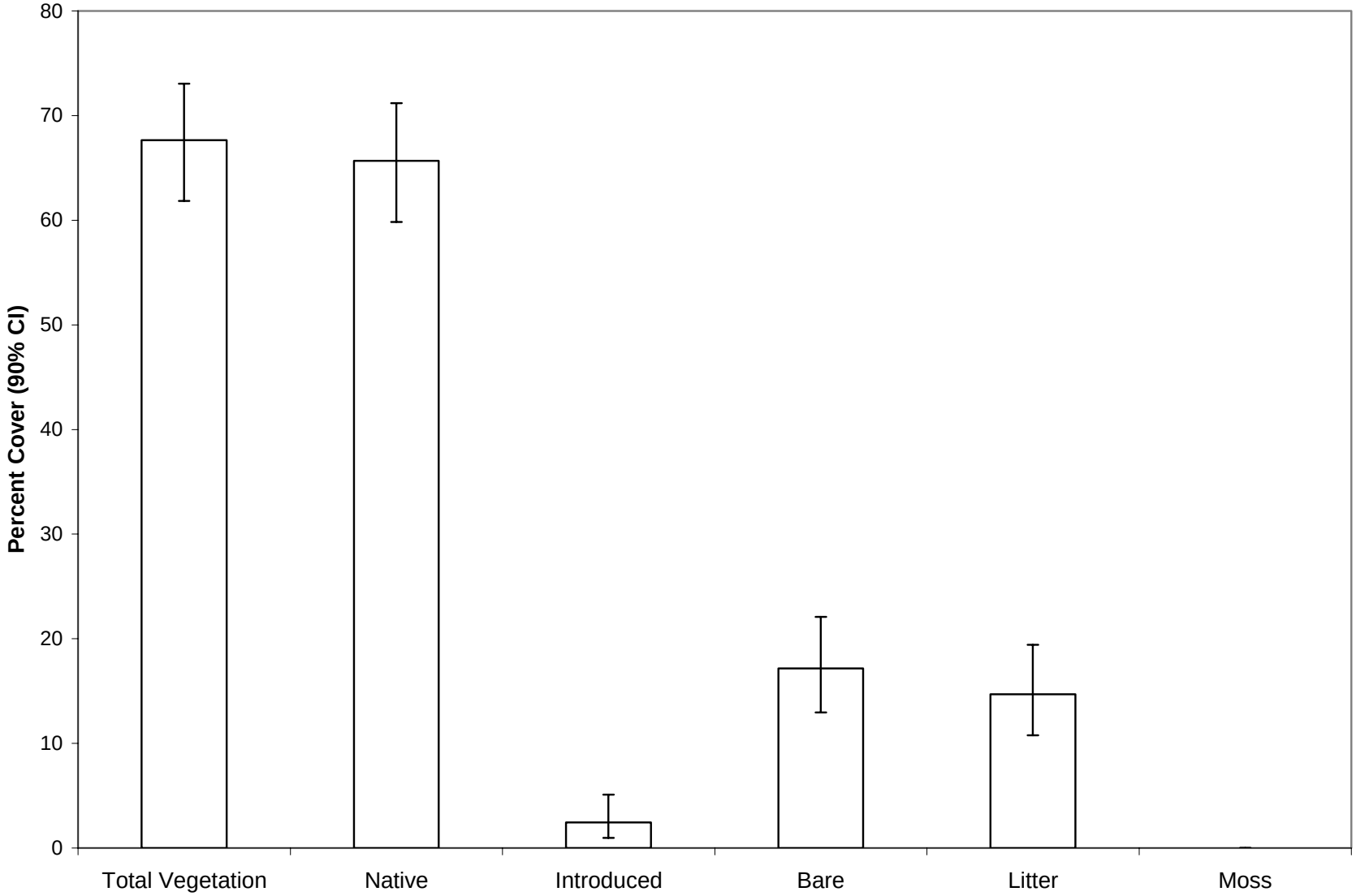


Figure 14.6. Percent cover of ground cover guilds in Macroplot 1 of the Turtle Swale Phase 1 Enhancement. The total percent cover of all vegetation, native species, introduced species, bare ground, litter and moss are graphed for macroplot 1 of the Turtle Swale Phase 1 Enhancement.

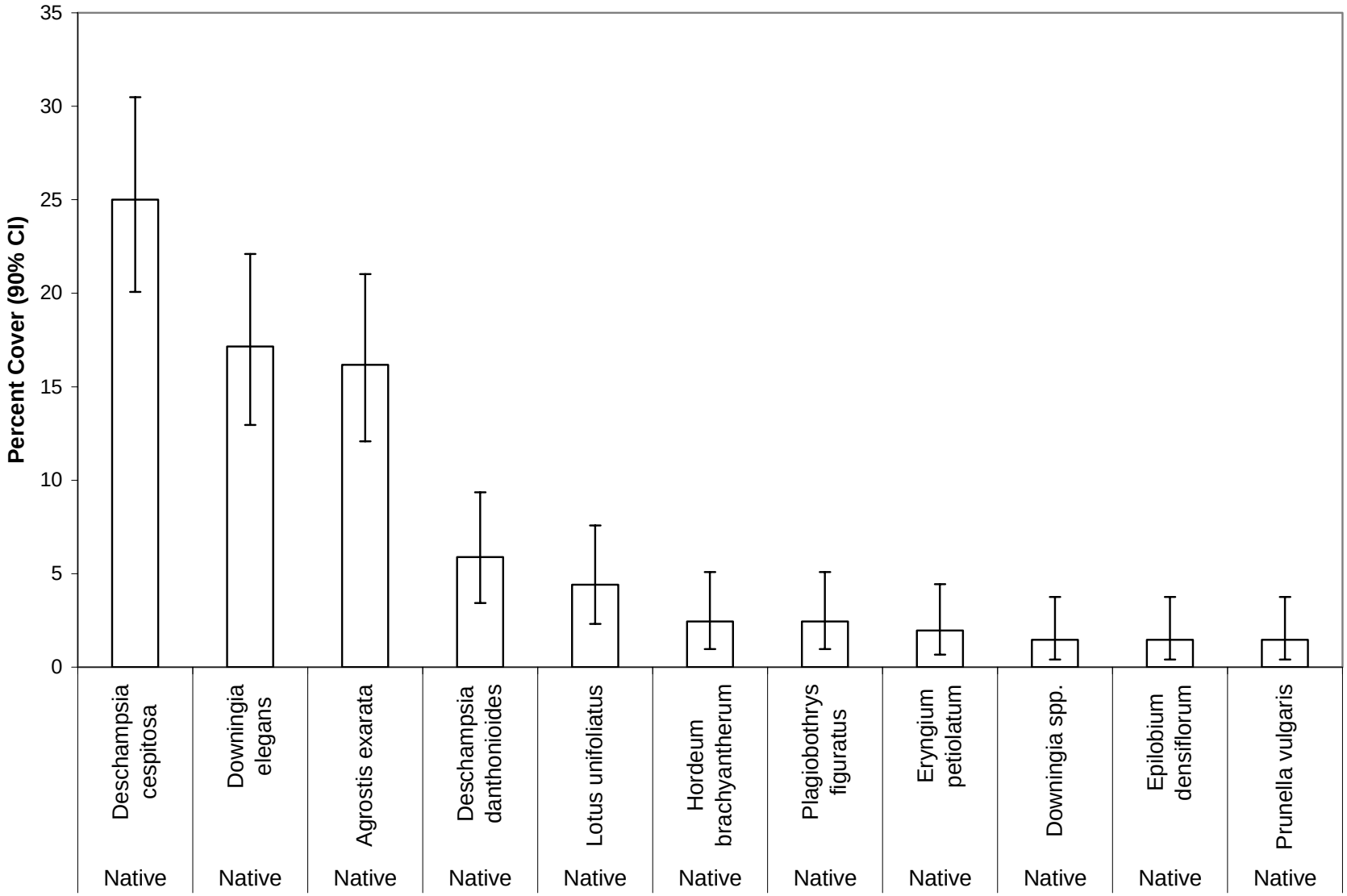


Figure 14.7. Species in the Turtle Swale Phase 1 Enhancement, Macroplot 1, with > 1% cover. All species in 2003 with greater than one percent cover are graphed for Turtle Swale Phase 1 Enhancement, Macroplot 1.

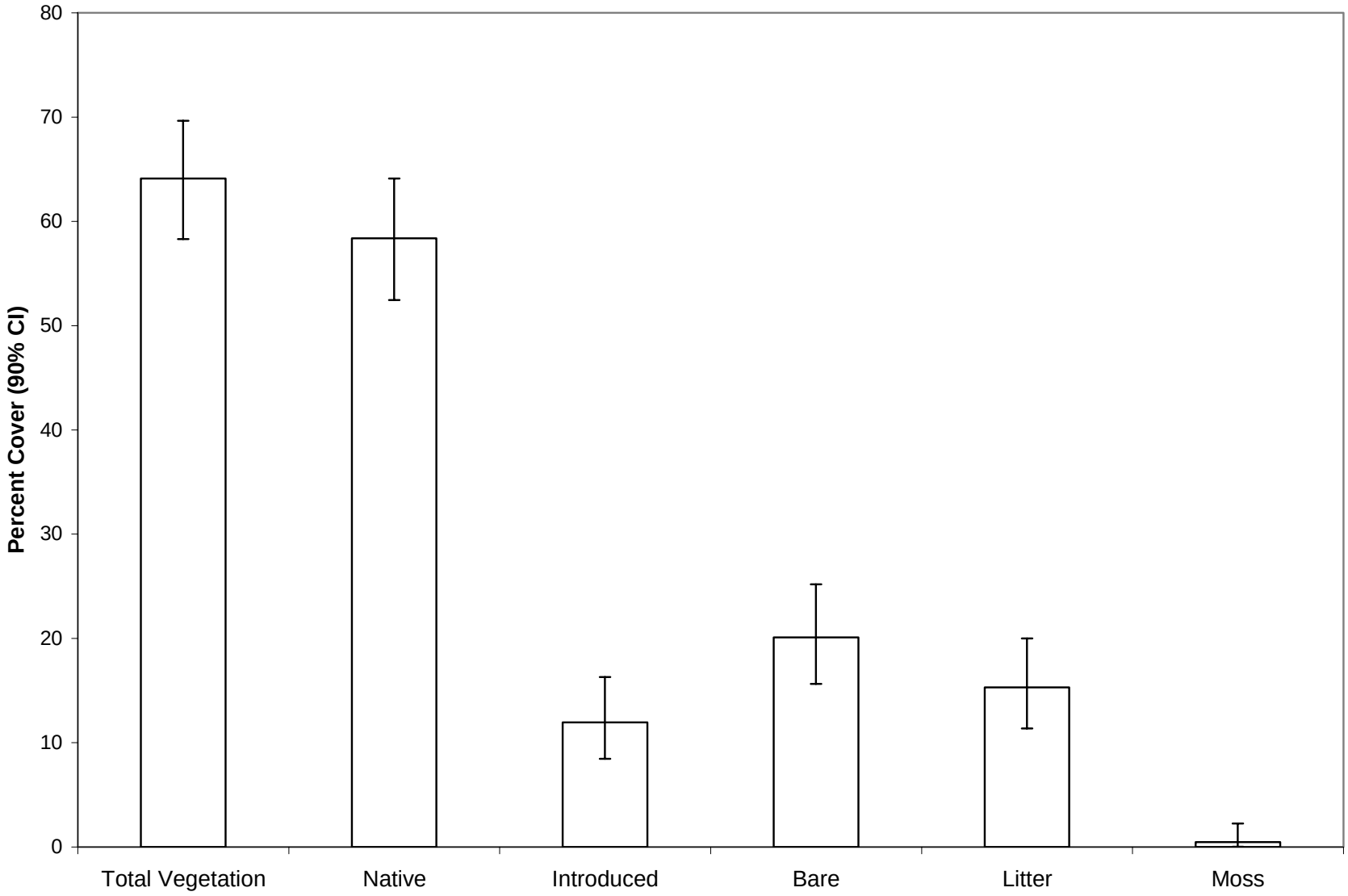


Figure 14.8. Percent cover of ground cover guilds in Macroplot 2 of the Turtle Swale Phase 1 Enhancement. The total percent cover of all vegetation, native species, introduced species, bare ground, litter and moss are graphed for macroplot 1 of the Turtle Swale Phase 2 Enhancement.

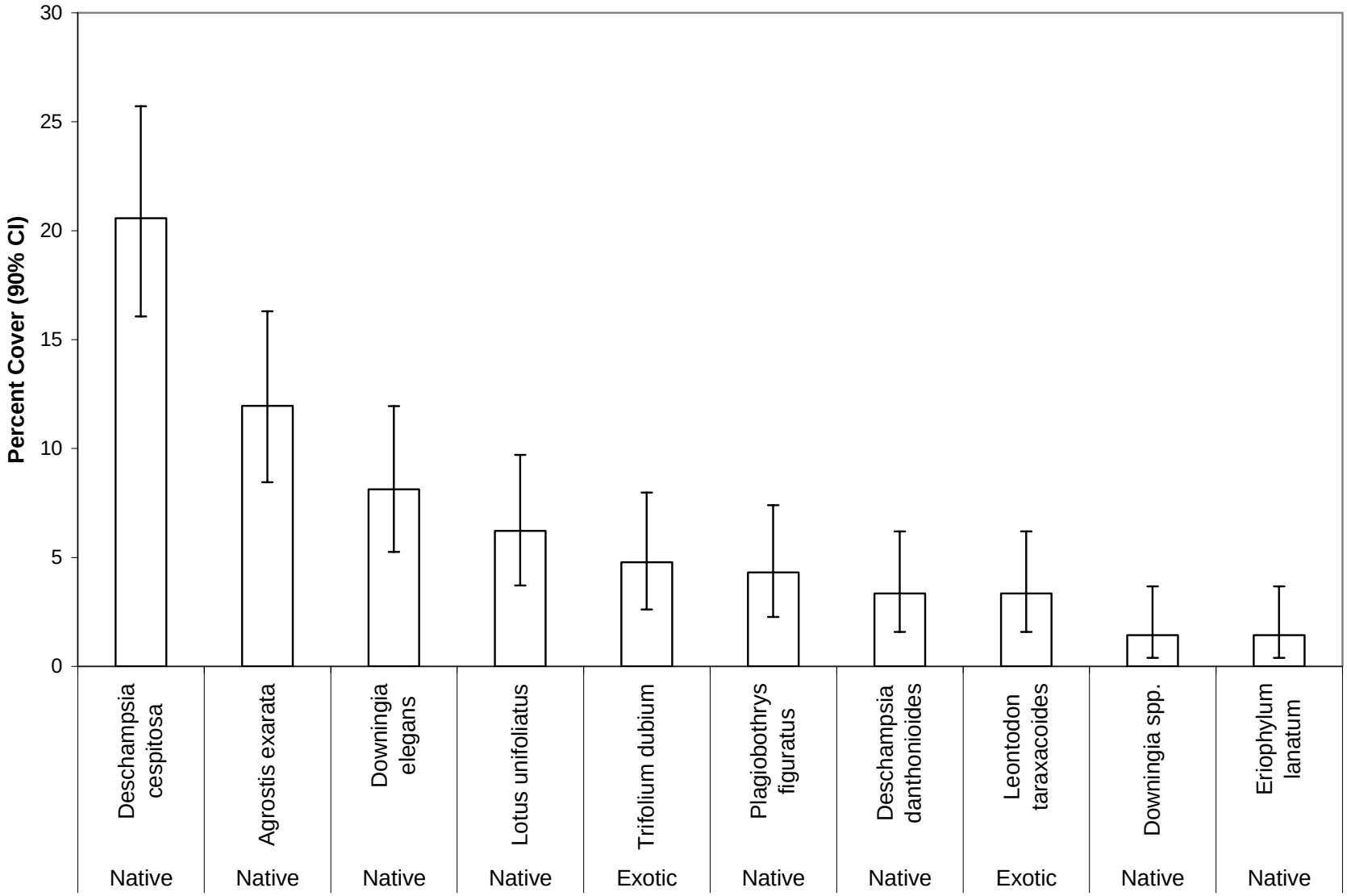


Figure 14.9. Species in the Turtle Swale Phase 1 Enhancement, Macroplot 2, with > 1% cover. All species in 2003 with greater than one percent cover are graphed for Turtle Swale Phase 1 Enhancement, Macroplot 2.

Results of Phase 2 Seed Assessment:
Three plant community mixes were planted in Phase 2 (Tables 14.3-14.5): 1) 12 acres of wet prairie, 2) 2.5 of vernal pool, and 3) 1.25 of emergent. Of the 40 species seeded in the wet prairie mix, 4 were 'Dominant,' 8 were 'Common,' 5 were 'Uncommon,' 9 were in 'Trace' amounts, and 14 were absent. In the vernal pool mix, 22 species were planted—3 were 'Dominant,' 3 were 'Common,' 7 were 'Uncommon,' 6 were in 'Trace' amounts, and 14 were absent. Of the 29 emergent species planted, 0 were 'Dominant,' 0 were 'Common,' 5 were 'Uncommon,' 5 were in 'Trace' amounts, and 19 were absent. Very few emergent species were observed because there is little to no emergent habitat in Phase 2. Of all the species observed, Deschampsia cespitosa, Agrostis exarata, *Dowingia elegans* (& *D. yina*), and *Plagiobothrys figuratus* appeared to cover the most ground; however, vegetation overall of Phase 2 was fairly sparse. The site was seeded again with the no-till drill and a wet prairie\vernal pool mix in the fall of 2003 (Table 14.6).

Table 14.3. Turtle Swale Phase 2 Wet Prairie Mix Seed Assessment. Twelve acres were seeded with a wet prairie mix. The table includes the species seeded, their prominence (rank), the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Scientific Name	Habitat	Rank	grams	grams/acre	% of mix
Agrostis exarata	FACW	Dominant	2760	230	10.12%
Allium amplectens	NOL*		36	3	0.13%
Aster hallii	NOL*	Trace	1200	100	4.40%
Brodiaea coronaria	NOL*		12	1	0.04%
Brodiaea hyacinthina	NOL*	Trace	12	1	0.04%
Camassia leichtlinii	FACW-		70	5.83	0.26%
Camassia quamash	FACW*		720	60	2.64%
Carex densa	OBL		720	60	2.64%
Carex unilateralis	FACW		1200	100	4.40%
Danthonia californica	FACU*		1380	115	5.06%
Deschampsia cespitosa	FACW	Dominant	4800	400	17.60%
Downingia elegans & yina	OBL	Dominant	684	57	2.51%
Epilobium densiflorum	FACW-	Common	1200	100	4.40%
Eriophyllum lanatum	NOL*	Common	600	50	2.20%
Grindelia integrifolia	FACW	Uncommon	600	50	2.20%
Hordeum brachyantherum	FACW-*	Common	1800	150	6.60%
Juncus ensifolius	FACW	Trace	24	2	0.09%
Juncus tenuis	FACW-		480	40	1.76%
Lotus formosissimus	FACW+	Trace	60	5	0.22%
Lotus unifoliatus	NOL*	Common	180	15	0.66%
Lupinus polyphyllus	FAC+	Trace	360	30	1.32%
Lupinus rivularis	FACU	Trace	600	50	2.20%
Luzula campestris	NOL*		24	2	0.09%
Madia glomerata	FACU+	Common	240	20	0.88%
Madia sativa	NOL*	Common	180	15	0.66%
Microseris laciniata	NOL*		1200	100	4.40%
Orthocarpus bracteosus	NOL*	Uncommon	60	5	0.22%
Orthocarpus hispidus	FACU-	Uncommon	12	1	0.04%

Table 14.3. Turtle Swale Phase 2 Wet Prairie Mix Seed Assessment. Twelve acres were seeded with a wet prairie mix. The table includes the species seeded, their prominence (rank), the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Scientific Name	Habitat	Rank	grams	grams/acre	% of mix
Panicum occidentale	FACW	Trace	60	5	0.22%
Perideridia oregana	NOL*		60	5	0.22%
Plagiobothrys figuratus	FACW	Dominant	720	60	2.64%
Potentilla gracilis	FAC		840	70	3.08%
Prunella vulgaris	FACU+	Common	600	50	2.20%
Ranunculus occidentalis	FAC		960	80	3.52%
Ranunculus orthorhynchus	FACW-	Uncommon	1200	100	4.40%
Rumex salicifolius	FACW		360	30	1.32%
Saxifraga oregana	FACW+		12	1	0.04%
Sisyrinchium idahoense	FACW		36	3	0.13%
Wyethia angustifolia	FACU		1200	100	4.40%
Zigadenous venenosus	FACU*		12	1	0.04%

Table 14.4. Turtle Swale Phase 2 Vernal Pool Mix Seed Assessment. Two and a half acres were seeded with a vernal pool mix. The table includes the species seeded, their prominence (rank), the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Scientific Name	Habitat	Rank	grams	grams/acre	% of mix
Agrostis exarata	FACW	Trace	575	230	5.82%
Beckmannia syzigachne	OBL	Trace	6000	2400	60.70%
Deschampsia cespitosa	FACW	Trace	250	100	2.53%
Downingia elegans & yina	OBL	Dominant	212.5	85	2.15%
Epilobium densiflorum	FACW-	Uncommon	100	40	1.01%
Eryngium petiolatum	OBL	Uncommon	55	22	0.56%
Glyceria occidentalis	OBL	Trace	125	50	1.26%
Gnaphalium palustre	FAC+	Dominant	25	10	0.25%
Gratiola ebracteata	OBL	Common	250	100	2.53%
Hordeum brachyantherum	FACW-*	Uncommon	1500	600	15.18%
Juncus acuminatus	FACQ-	Uncommon	125	50	1.26%
Juncus bolanderi	OBL		25	10	0.25%
Juncus ensifolius	FACW		5	2	0.05%
Lasthenia glaberrima	OBL	Trace	125	50	1.26%
Madia glomerata	FACU+	Trace	50	20	0.51%
Microsteris gracilis	FACU	Uncommon	22	8.8	0.22%
Navarretia intertexta	FACW	Common	62.5	25	0.63%
Plagiobothrys figuratus	FACW	Dominant	150	60	1.52%
Psilocarphus elatior	FACW+	Uncommon	15	6	0.15%
Rorripa curvisiliqua	OBL	Common	50	20	0.51%
Rumex salicifolius	FACW		75	30	0.76%
Veronica peregrina	OBL	Uncommon	87.5	35	0.89%

Table 14.5. Turtle Swale Phase 2 Emergent Mix Seed Assessment. One and a half acres were seeded with an emergent community mix. The table includes the species seeded, their prominence (rank), the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Scientific Name	Habitat	Rank	grams	grams/acre	% of mix
Agrostis exarata	FACW		287.5	230	5.77%
Alisma plantago-aquatica	OBL	Trace	125	100	2.51%
Beckmannia syzigachne	OBL	Trace	3000	2400	60.21%
Carex densa	OBL	Trace	25	20	0.50%
Downingia elegans & yina	OBL	Uncommon	106.25	85	2.13%
Eleocharis ovata	OBL		30	24	0.60%
Eleocharis palustris	OBL		81.25	65	1.63%
Epilobium densiflorum	FACW-		50	40	1.00%
Eryngium petiolatum	OBL		27.5	22	0.55%
Glyceria occidentalis	OBL		125	100	2.51%
Gnaphalium palustre	FAC+	Uncommon	12.5	10	0.25%
Hordeum brachyantherum	FACW-*	Uncommon	375	300	7.53%
Juncus acuminatus	FACW-	Uncommon	62.5	50	1.25%
Juncus bolanderi	OBL		12.5	10	0.25%
Juncus ensifolius	FACW		25	20	0.50%
Juncus oxymeris	FACW+	Trace	37.5	30	0.75%
Juncus patens	FACW		37.5	30	0.75%
Ludwigia palustris	OBL	Trace	25	20	0.50%
Madia glomerata	FACU+		25	20	0.50%
Myosotis laxa	OBL		6.25	5	0.13%
Polygonum hydropiperoides	OBL		75	60	1.51%
Ranunculus alismafolius	FACW		37.5	30	0.75%
Rorripa curvisiliqua	OBL		25	20	0.50%
Rumex salicifolius	FACW		37.5	30	0.75%
Scirpus validus	OBL		125	100	2.51%
Sparganium emersum	OBL		112.5	90	2.26%
Veronica scutellata	OBL	Uncommon	93.75	75	1.88%

Table 14.6. Turtle Swale Phase 2 Wet Prairie/Vernal Pool Re-seeding Mix. Fifteen acres were re-seeded with a wet prairie/vernal pool community mix. The table includes the species seeded, their prominence (rank), the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Scientific Name	Habitat	grams	grams per acre	% of seed mix
Agrostis exarata	FACW	4500	300.0	8.91%
Allium amplectens	NOL*	150	10.0	0.30%
Aster hallii	NOL*	2250	150.0	4.45%
Beckmannia syzigachne	OBL	0	0.0	0.00%
Brodiaea coronaria	NOL*	75	5.0	0.15%
Brodiaea hyacinthina	NOL*	150	10.0	0.30%
Camassia leichtlinii	FACW-	900	60.0	1.78%
Camassia quamash	FACW*	1500	100.0	2.97%
Carex densa	OBL	2250	150.0	4.45%
Carex unilateralis	FACW	2250	150.0	4.45%
Danthonia californica	FACU*	1875	125.0	3.71%
Deschampsia cespitosa	FACW	5942	396.1	11.76%

Table 14.6. Turtle Swale Phase 2 Wet Prairie/Vernal Pool Re-seeding Mix. Fifteen acres were re-seeded with a wet prairie/vernal pool community mix. The table includes the species seeded, their prominence (rank), the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Scientific Name	Habitat	grams	grams per acre	% of seed mix
Downingia elegans & yina	OBL	1425	95.0	2.82%
Epilobium densiflorum	FACW-	3000	200.0	5.94%
Eriophyllum lanatum	NOL*	750	50.0	1.48%
Eryngium petiolatum	OBL	750	50.0	1.48%
Glyceria occidentalis	OBL	1500	100.0	2.97%
Gnaphalium palustre	FAC+	50	3.3	0.10%
Gratiola ebracteata	OBL	1510	100.7	2.99%
Grindelia integrifolia	FACW	750	50.0	1.48%
Hordeum brachyantherum	FACW-*	2250	150.0	4.45%
Juncus acuminatus	FACW-	100	6.7	0.20%
Juncus tenuis	FACW-	600	40.0	1.19%
Lomatium nudicaule	NOL*	750	50.0	1.48%
Lotus formosissimus	FACW+	75	5.0	0.15%
Lotus unifoliatus	NOL*	225	15.0	0.45%
Lupinus polyphyllus	FAC+	750	50.0	1.48%
Lupinus rivularis	FACU	750	50.0	1.48%
Luzula campestris	NOL*	75	5.0	0.15%
Madia elegans	NOL*	70	4.7	0.14%
Madia glomerata	FACU+	225	15.0	0.45%
Madia sativa	NOL*	750	50.0	1.48%
Microseris laciniata	NOL*	2250	150.0	4.45%
Microsteris gracilis	FACU	50	3.3	0.10%
Orthocarpus bracteosus	NOL*	150	10.0	0.30%
Orthocarpus hispidus	FACU-	75	5.0	0.15%
Panicum occidentale	FACW	225	15.0	0.45%
Perideridia oregana	NOL*	373	24.9	0.74%
Plagiobothrys figuratus	FACW	900	60.0	1.78%
Potentilla gracilis	FAC	1500	100.0	2.97%
Prunella vulgaris	FACU+	750	50.0	1.48%
Psilocarphus elatior	FACW	150	10.0	0.30%
Ranunculus occidentalis	FAC	1400	93.3	2.77%
Ranunculus orthorhynchus	FACW-	1050	70.0	2.08%
Rorripa curvisiliqua	OBL	50	3.3	0.10%
Rumex salicifolius	FACW	450	30.0	0.89%
Saxifraga oregana	FACW+	120	8.0	0.24%
Sisyrinchium idahoense	FACW	225	15.0	0.45%
Veronica peregrina	OBL	60	4.0	0.12%
Wyethia angustifolia	FACU	2250	150.0	4.45%
Zigadenous venenosus	FACU*	301	20.1	0.60%

3. Wildlife Utilization

The large amount of contiguous habitat of the Lower Amazon Restoration Project, of which Turtle Swale is apart, attracts large numbers and a wide variety of wildlife. Specific sightings for Turtle Swale include killdeer and their nests, redwing blackbirds, green heron, blue heron, mallards, red-tailed hawks, and osprey.

Chapter 15: Willow Corner Unit

A. Site Description

1. Size: 6.4 acres

2. Ownership: City of Eugene

3. Site Timeline: **Table 15.1. Willow Corner Unit site timeline.**

Section	Treatment and Construction Years	Acreage	Monitoring Period
Wet Prairie Restoration	2003	6.15	2004-2008
Emergent Enhancement	2003	0.20	2004-2008
Upland Restoration	2003	0.05	2004-2008

4. Location

The Willow Corner Unit is located at the southwestern corner of 18th Avenue and Bertelsen Road. It is bordered to the west and south by land owned by The Nature Conservancy.

5. Baseline Conditions

Historically, the site was likely dominated by wet prairie, with a minor component of upland prairie. However, over the past two decades, large quantities of fill material were dumped and spread out over the area in anticipation of future commercial development. Cottonwood, willows, and Himalayan blackberry grew on top of the fill to make up the majority of the vegetation.

6. Focus of Prescriptions

Approximately 50,000 cubic yards of material was removed from 6.4 acres of land owned by the City of Eugene and approximately 6.5 acres owned by The Nature Conservancy. The area was then planted with appropriate seed mixes and augmented with plugs.

7. Site-Specific Management Goals

1. Restore native wet prairie vegetation to areas where fill was removed.
2. Control invasive plant species in areas immediately adjacent to the proposed restoration to prevent their spread into the newly graded areas. This includes reed canarygrass, harding grass, pennyroyal, teasel, Scot's broom, and Himalayan blackberry.
3. Enhance existing wet prairie vegetation by removing exotic species and re-establishing native wet prairie species.
4. Minimize impacts to existing adjacent wetland and upland prairie areas and rare plant populations during restoration and enhancement activities.

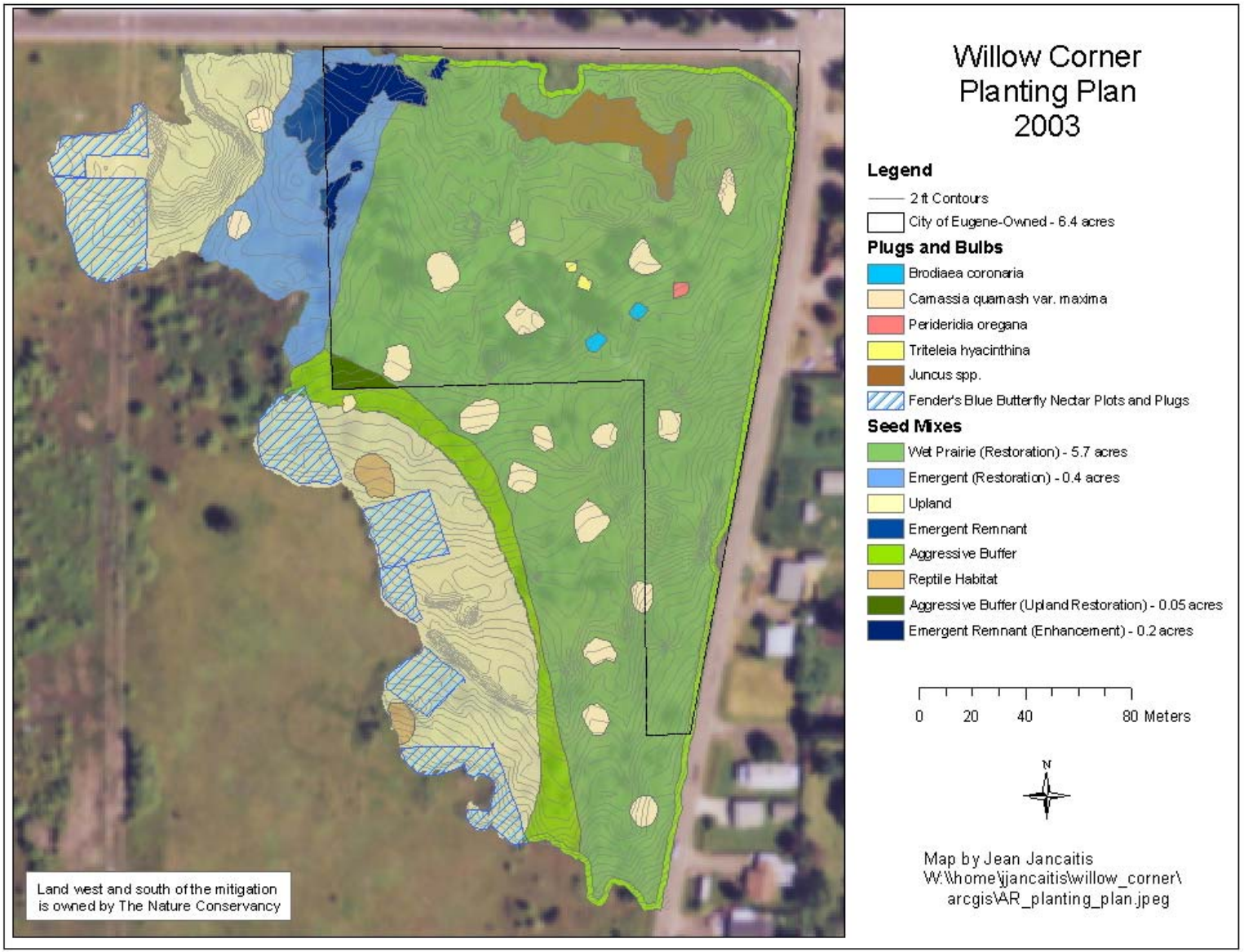


Figure 15.1. Willow Corner Unit – 2003 Project Map and Planting Plan. The map shows the mitigation, on land owned by the City of Eugene, labeled with the number of acres mitigated. The map also illustrates the planting plan for the entire restoration. No credits will be generated from restoration completed on land owned by The Nature Conservancy.

B. 2003 Monitoring Summary

Approximately 50,000 cubic yards of material was removed from the site in the fall of 2003. The area was then seeded with habitat-appropriate seed mixes. *Camassia quamash* var. *maxima* bulbs salvaged from a nearby development site and several other species grown for the project were planted as bulbs or plugs to augment diversity on the site. A staff gauge was installed in the northeastern portion of the site to monitoring site hydrology.

1. 2003 Management Actions

1. 50,000 cubic yards of fill material was removed.
2. Upland prairie, wet prairie, emergent, and vernal pool seed mixed were distributed across the site based on predicted hydrology.
3. 12,000 salvaged *Camassia quamash* var. *maxima* bulbs were planted
4. The following plugs and bulbs were planted:

Table 15.2. Plugs and Bulbs Planted at Willow Corner in the fall of 2003. The plugs and bulbs planted at Willow Corner in the fall of 2003 are listed with their planting type and the quantity planted.

Species	Planting Type	Quantity
Brodiaea coronaria	1 and 2 year old bulbs	90
Camassia quamash var. maxima	salvaged bulbs	~ 10000
Perideridia oregana	1-yr old cones	50
Triteleia hyacinthina	2-yr old cones	33
Triteleia hyacinthina	1-yr old cones	49
Deschampsia cespitosa	plugs	78
Agrostis exarata	plugs	78
Juncus bolanderi	plugs	78
Juncus ensifolius	plugs	78
Deschampsia cespitosa	plugs	78
Juncus patens	plugs	78
Juncus tenuis	plugs	78
Agrostis exerata	plugs	78

2. Management Actions for 2004

1. Intensively hand weed non-native species from the restoration.
2. Spot herbicide Himalayan blackberry.

Table 15.3. Progress of the Willow Corner Unit Restoration and Enhancement towards meeting the MOA vegetation standards. The most recent data for each section are compared to their relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Vegetation Standard in MOA	Restoration	Goal Met?
Site status in the monitoring period	2004-2008	N/A
70% native **cover** after 5 years	2005	TBD
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2008	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2008	TBD
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2008	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2008	TBD

C. Monitoring Results

1. Hydrology

Hydrology monitoring will begin in 2004.

2. Vegetation

Vegetation monitoring will begin in 2004.

Wet prairie, upland prairie, emergent, vernal pool, and an aggressive buffer seed mixes (Tables 15.4-15.7) were drilled or broadcast on the site based on predicted hydrology. All acreages listed in the tables are for the City of Eugene portion of the site only. An assessment of the seeding success will take place in 2004.

Table 15.4. Willow Corner Wet Prairie Mix. 5.6 acres were seeded with a wet prairie mix. The table includes the species seeded, the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Species	Weight (grams)	grams/acre	% of Mix
Agrostis exarata	1155.75	203.05	5.43%
Aster hallii	1340.00	235.42	6.30%
Beckmannia syzigachne	546.05	95.93	2.57%
Brodiaea coronaria	33.50	5.89	0.16%
Brodiaea hyacinthina	33.50	5.89	0.16%
Camassia leichtlinii	670.00	117.71	3.15%
Camassia quamash	668.66	117.47	3.14%
Camassia quamash	1.34	0.24	0.01%

Table 15.4. Willow Corner Wet Prairie Mix. 5.6 acres were seeded with a wet prairie mix. The table includes the species seeded, the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Species	Weight (grams)	grams/acre	% of Mix
Carex densa	546.05	95.93	2.57%
Danthonia californica	1340.00	235.42	6.30%
Deschampsia cespitosa	1507.50	264.85	7.08%
Downingia elegans & yina	167.50	29.43	0.79%
Downingia yina	167.50	29.43	0.79%
Epilobium densiflorum	670.00	117.71	3.15%
Eriophyllum lanatum	1022.42	179.62	4.80%
Grindelia integrifolia	603.00	105.94	2.83%
Hordeum brachyantherum	1005.00	176.56	4.72%
Juncus ensifolius	23.45	4.12	0.11%
Juncus ensifolius	43.55	7.65	0.20%
Juncus nevadensis	3.35	0.59	0.02%
Juncus tenuis	268.00	47.08	1.26%
Lomatium nudicaule	335.00	58.85	1.57%
Lotus formosissimus	31.49	5.53	0.15%
Lotus formosissimus	2.01	0.35	0.01%
Lotus unifoliatus	100.50	17.66	0.47%
Lupinus polyphyllus	201.00	35.31	0.94%
Luzula campestris	33.50	5.89	0.16%
Madia glomerata	234.50	41.20	1.10%
Madia sativa	167.50	29.43	0.79%
Microseris laciniata	2010.00	353.13	9.44%
Microsteris gracilis	26.80	4.71	0.13%
Orthocarpus bracteosus	67.00	11.77	0.31%
Orthocarpus hispidus	33.50	5.89	0.16%
Panicum accuminatum	100.50	17.66	0.47%
Perideridia oregana	167.50	29.43	0.79%
Plagiobothrys figuratus	402.00	70.63	1.89%
Poa scabrella	134.00	23.54	0.63%
Potentilla gracilis	2010.00	353.13	9.44%
Prunella vulgaris	670.00	117.71	3.15%
Pyrocoma racemosa	72.36	12.71	0.34%
Ranunculus occidentalis	670.00	117.71	3.15%
Ranunculus orthorhynchus	268.00	47.08	1.26%
Rumex salicifolius	201.00	35.31	0.94%
Saxifraga oregana	53.60	9.42	0.25%
Sisyrinchium idahoense	134.00	23.54	0.63%
Wyethia angustifolia	2010.00	353.13	9.44%
Zigadenous venenosus	134.00	23.54	0.63%

Table 15.5. Willow Corner Vernal Pool Mix. 0.34 acres were seeded with a vernal pool mix. The table includes the species seeded, the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Species	Weight (grams)	grams/acre	% of Mix
Agrostis exarata	387	1138.59	12.56%
Alopecurus geniculatus	52	151.81	1.68%
Beckmannia syzigachne	258	759.06	8.38%
Deschampsia cespitosa	645	1897.65	20.94%
Downingia elegans & yina	129	379.53	4.19%
Downingia yina	129	379.53	4.19%
Epilobium densiflorum	258	759.06	8.38%
Eryngium petiolatum	129	379.53	4.19%
Gnaphalium palustre	26	75.91	0.84%
Gratiola ebracteata	267	785.63	8.67%
Juncus acuminatus	90	265.67	2.93%
Juncus bolanderi	26	75.91	0.84%
Juncus ensifolius	26	75.91	0.84%
Lasthenia glaberrima	65	189.76	2.09%
Lasthenia glaberrima	65	189.76	2.09%
Navarretia intertexta	104	305.52	3.37%
Plagiobothrys figuratus	155	455.44	5.03%
Psilocarphus elatior	26	75.91	0.84%
Rorripa curvisiliqua	77	227.72	2.51%
Rumex salicifolius	77	227.72	2.51%
Veronica peregrina	90	265.67	2.93%

Table 15.6. Willow Corner Emergent Mix. 0.17 acres were seeded with an emergent mix. The table includes the species seeded, the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Species	Weight (grams)	grams/acre	% of Mix
Agrostis exarata	102	598.94	8.95%
Beckmannia syzigachne	272	1597.18	23.86%
Carex densa	102	598.94	8.95%
Downingia elegans and D. yina	17	99.82	1.49%
Eleocharis ovata	7	39.93	0.60%
Eleocharis palustris	41	242.07	3.62%
Eleocharis palustris	3	15.47	0.23%
Epilobium densiflorum	68	399.29	5.96%
Eryngium petiolatum	15	87.84	1.31%
Gentiana sceptrum	3	19.96	0.30%
Glyceria occidentalis	136	798.59	11.93%
Gnaphalium palustre	7	39.93	0.60%
Hordeum brachyantherum	102	598.94	8.95%
Juncus acuminatus	24	139.75	2.09%
Juncus bolanderi	7	39.93	0.60%
Juncus ensifolius	7	39.93	0.60%
Juncus oxymeris	20	119.79	1.79%
Juncus patens	20	119.79	1.79%

Ludwigia palustris	14	79.86	1.19%
Madia glomerata	10	59.89	0.89%
Myosotis laxa	3	19.96	0.30%
Navarretia intertexta	3	19.96	0.30%
Polygonum hydropiperoides	34	199.65	2.98%
Ranunculus alismafolius	41	239.58	3.58%
Rorripa curvisiliqua	10	59.89	0.89%
Rumex salicifolius	20	119.79	1.79%
Veronica scutellata	51	299.47	4.47%

Table 15.7. Willow Corner Aggressive Buffer Mix. 0.27 acres were seeded with an aggressive buffer mix. The table includes the species seeded, the total grams seeded, the number of grams used per acre, and the percentage of each mix the seed occupied.

Species	Weight (grams)	grams/acre	% of Mix
Agrostis exarata	109	489.96	13.34%
Deschampsia cespitosa	130	581.75	15.84%
Elymus glaucus	571	2562.67	69.78%
Prunella vulgaris	4	19.85	0.54%
Wyethia angustifolia	4	19.85	0.54%

Chapter 16: Willow Creek Confluence Unit

A. Site Description

1. Size: 4.2 acres

2. Ownership: BLM

3. *Site Timeline:* **Table 16.1. Willow Creek Confluence Unit site timeline.**

Section	Year of Construction	Monitoring Period
Phase 1-East	1995	1996-2004*
Phase 1-West	1995	1996-2004*
Phase 2	1997	1998-2004*
Phase 3	1997	1998-2004*

*The monitoring period was extended because phases were combined for monitoring.

4. Location

The Willow Creek component of the BLM Wetland Field Office Management Area is located on the south side of Amazon Creek at the confluence of Willow and Amazon Creeks. The site sits on the northwestern corner of the intersection of Beltline Rd. with West 11th Ave.

5. Site History

Historically, 2-3' of fill material was deposited and spread across the site in preparation for development. In the past fifty years the site has been used for agriculture, as a parking lot, and as a storage yard.

6. Focus of Prescriptions

Restoration of wet prairie has been accomplished through a number of activities. Approximately 15,000 cubic yards of fill were removed from the site to expose the original hydric soils. Laying back the banks of Willow Creek allowed the expansion of the low flow channel and created a terraced riparian zone enhanced the riparian corridor along Willow Creek. A small backwater pond at the confluence of Willow Creek and Amazon Creek was created. The swale running west to east that conveys surface water flows from wetlands to the east of Beltline Road was widened and enhanced with willow plantings. The entire site was seeded with native wet prairie, vernal pool, emergent, and deep-water species.

7. Site-Specific Management Goals

1. Restore native wet prairie by removing fill down to the original hydric soil surface.
2. Expand the riparian zone along Willow Creek by excavating a wider channel and planting riparian vegetation.
3. Create wildlife habitat.
4. Create a narrow riparian habitat that conveys surface flows from wetlands east of Beltline Road across the site to the Willow Creek/Amazon Creek confluence, and that allows natural filtration prior to entering Willow Creek.

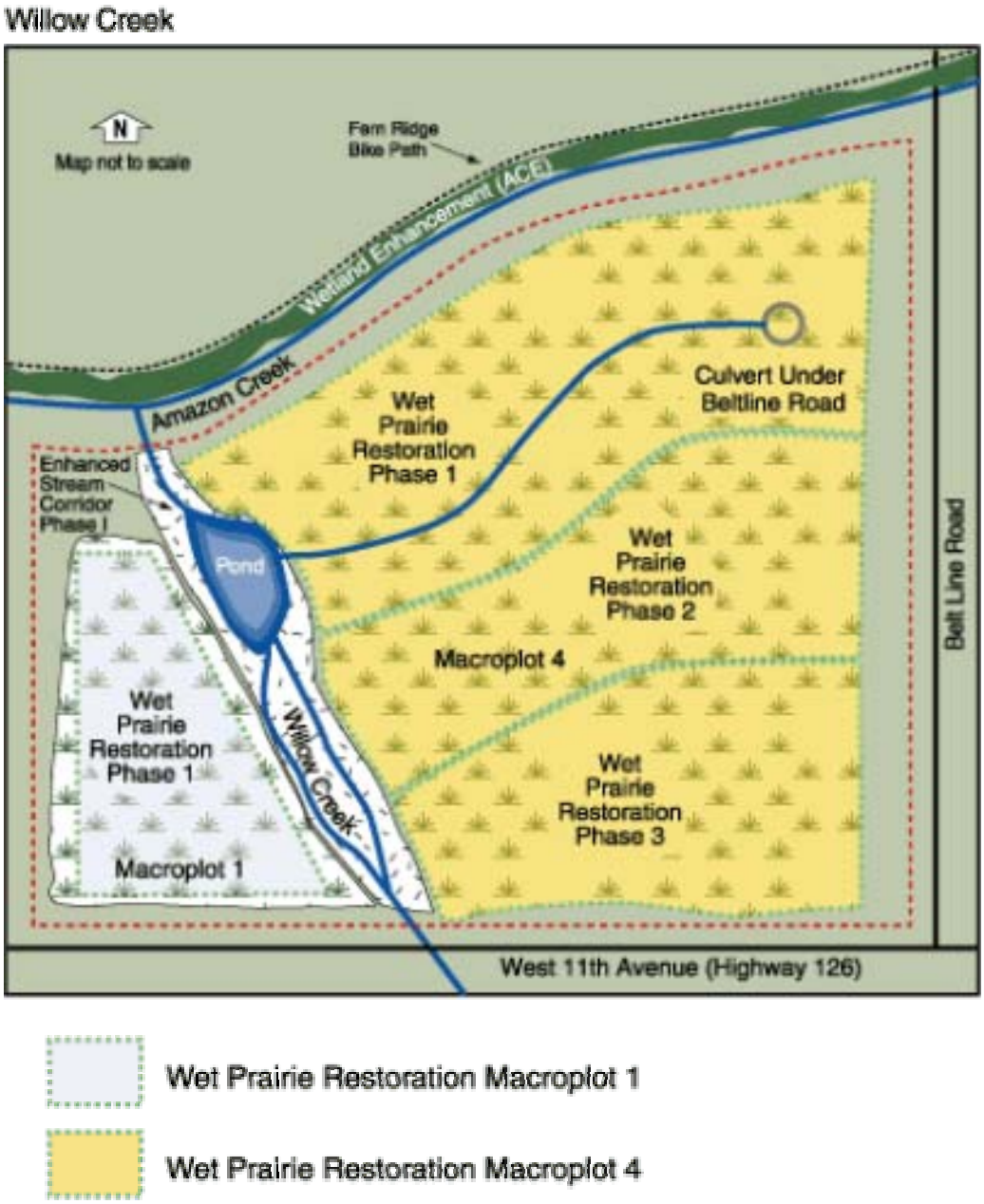


Figure 16.1. Willow Creek Confluence Site Map. All phases of the restoration for Willow Creek Confluence Unit are labeled with their associated macroplots.

B. 2003 Monitoring Summary

The eastern and western sides of Willow Creek support different habitat types. The east side is comprised entirely of wet prairie and vernal pool habitats and it appears to be ready to pass all mitigation bank success criteria is 2004. The western side of Willow Creek is mostly emergent and vernal pool habitat, with a patch of wet prairie in the northeast. Exotic species have been a larger problem in this section and were removed by hand weeding or with solarization in 2003. These areas will be monitored to see if further treatment is necessary. Both sides of the creek have populations of *Mentha pulegium, Phalaris arundinacea,* and *Phalaris aquatica*. *Mentha pulegium* will be hand weeded, while populations of *Phalaris arundinacea* and *Phalaris aquatica* will be mowed and solarized.

1. 2003 Management Actions

1. A half day was spent mowing the perimeter of the site.
2. A maintenance crew spent two days weeding the Willow Creek Unit.
3. A maintenance crew spent five and a half days solarizing patches of Harding grass and reed canarygrass.

2. Management Actions for 2004

1. The perimeter will be mowed to prevent the spread of exotics into the restoration area.
2. Continue to annually mow the top of the bank of Amazon Creek to keep blackberries from spreading onto the site.
3. Continue to manage Harding grass (*Phalaris aquatica*), colonial bentgrass (*Agrostis capillaris*) and blackberry as it occurs across the site.
4. Hand weed Queen Anne's lace (*Daucus carota*) located along the east-west swale using stream team volunteers.
5. Continue to clip teasel (*Dipsacus fullonum*) heads to prevent its spread.
6. Remove the small patches of reed canary-grass (*Phalaris arundinacea*) that are occurring in the bottom of the east-west swale.
7. Continue to hand weed pennyroyal (*Mentha pulegium*) on the east side of the site in preparation for monitoring.
8. The results of the 2003 solarization were generally poor, primarily due to quality of work by youth crews. Maintenance crews will re-solarize some of the less successful plots and hand weed the other plots based on an assessment of success in the spring. Future solarization by youth crews will have additional supervision.

Table 16.2. Progress of the Willow Confluence Unit towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Vegetation Standard in MOA	East Side of Willow Creek.	Goal Met?	West Side of Willow Creek	Goal Met?
Site status in the monitoring period	Phases 1 east, 2 & 3 in year 7 of 8	N/A	Phase 1 west in year 7 of 9	N/A
Most recent quantitative data collected in:	PI - 2002	N/A	PI - 2001	N/A
50% native **cover** after 2 years and 70% native **cover** after 5 years	69%	Yes	52%	No
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2004	TBD	2004	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	41 of 68, or 60%	No	18 of 41, or 50%	No
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2004	TBD	2005	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2004	TBD	2005	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during site visits in the 2nd quarter (April-June) and the 4th quarter (Oct.-Dec.).

b) Results

The eastern side of Willow Creek continues to function as a mixture of vernal pool and wet prairie habitat. It contains numerous large pools (~3-10 ft. in diameter) that reach up to 4 inches deep. The western side of Willow Creek holds more water until later in the growing season. Here the pools reach up to 8 inches deep and cover the majority of the site. It functions more as a mixture of emergent wetland and vernal pool habitat in the south and grades into wet prairie in the north. The pattern and duration of saturation and inundation observed on the site is sufficient to support hydric soils and wetland vegetation development.

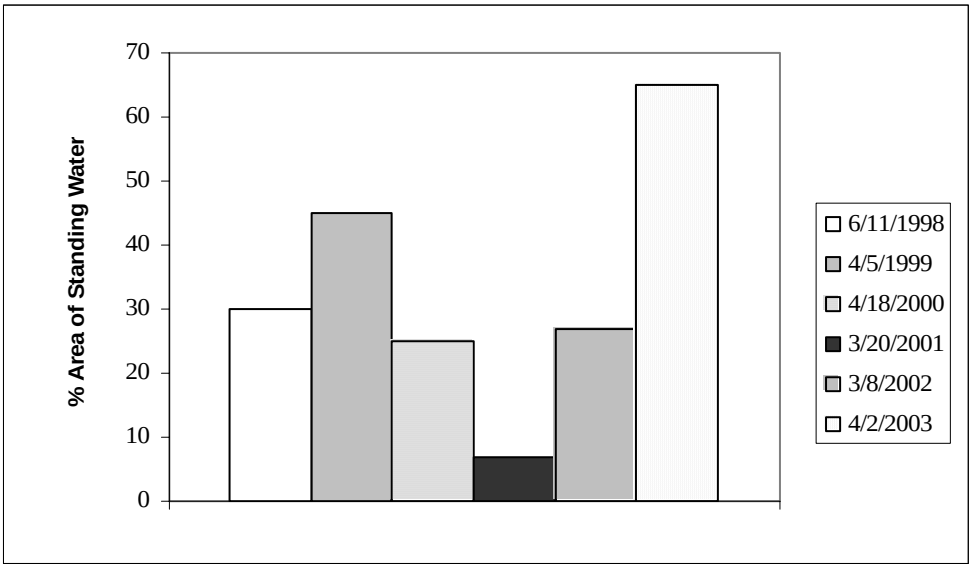


Figure 16.2. Spring standing water in the Willow Creek Confluence Unit. Percentage of the site with standing water in the early spring over the history of the restoration.

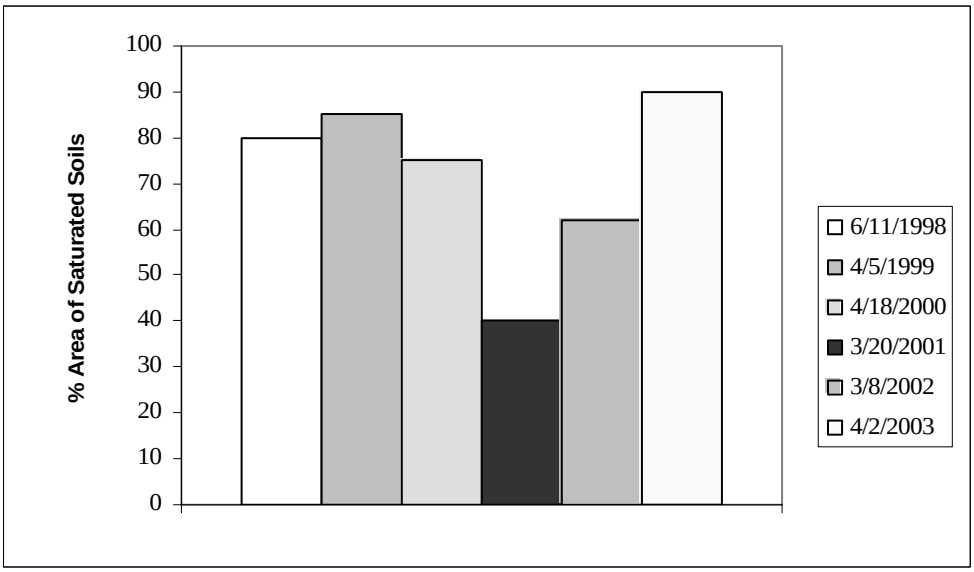


Figure 16.3. Spring saturated soils in the Willow Creek Confluence Unit. Percentage of the site with surface saturated soils in the early spring over the history of the restoration.

2. Vegetation

a) Methods

No quantitative vegetation data were collected in 2003. Final year monitoring for the east side of Willow Creek will occur in 2004 and in 2005 for the west side. A species list was compiled for the entire site and can be viewed in Appendix B.

3. Wildlife Utilization

Wildlife use was similar to previous years (see 1998-2002 Annual Reports).

Appendix A. Monitoring Methods

Overview
A mitigation bank monitoring strategy was developed in the spring of 1997 describing mitigation goals and monitoring objectives common to all sites, site-specific goals, and monitoring objectives for existing restoration and enhancement projects. A standard field protocol for qualitative quarterly site monitoring was implemented in the fall of 1997. As new Mitigation Improvement Plans (MIPs) were written, mitigation goals and monitoring objectives were added. Improvements to the protocol were made based on field experiences in 1998. The standard plan and the protocol for quantitative vegetative monitoring were both developed in 1994 (see 1994 Annual Report for details).

A discussion of each type of monitoring is provided in the following sections.

Quarterly Monitoring

Photopoints
Purpose: Photos document surface hydrology and vegetation structure during each season, and allow comparisons between post-treatment years.
Method:
- Permanent photostations are established with metal stakes in a sufficient number to provide photo coverage of most restored and enhanced areas at all current sites.
- Photographs are taken quarterly and documented by photopoint number and compass bearing (and landmarks).

Hydrology
Purpose: Assess whether wetland hydrology is established within the restoration site. The extent of soil saturation during the growing season (March 18 – November 26) is an important factor in establishment and growth of hydrophytic vegetation.
Method:
1. Quarterly site visits during the fall, winter, and spring have included a brief description of the location, extent, and depth of standing water at each site.
2. The timing of the quarterly visits in the fall and spring should correspond with the beginning and end of the growing season, if possible.
3. The winter visit should document the maximum standing water depth and extent in emergent pools.
4. Water depth is recorded monthly beginning in October and running through May from the 1 or 2 staff gauges installed at most sites.

Vegetation Monitoring

Overall Goal: Assess the establishment of hydrophytic vegetation within restoration sites and monitor the status of hydrophytic vegetation in enhancement sites.

Species Lists
Purpose: Assess the status of each site in meeting the following Bank MOA performance standard: The standard reads that, “At least 70 percent of the planted or seeded native plants shall be present at the end of the five year monitoring period.”
Method:

1. The species list should be collected once early in the growing season (late May to mid-June) and once late in the growing season (early to mid-August).
2. A species list is compiled by thoroughly walking through a site while filling out the species checklist.

Seed Assessments
Purpose: To provide and early qualitative assessment of seeding success.
Method:
1. The assessment should take place once early in the growing season (late May to mid-June) and once late in the growing season (early to mid-August).
2. Each native species is noted, while also recording whether its presence in the restoration is 'Dominant,' 'Common,' 'Uncommon,' or present only in 'Trace' amounts."

Point-intercept Sampling
Purpose: To address the performance criteria for species importance in wetland restorations given in the MOA as: "…the restored wetland shall be dominated by native plant species where their total represents at least 50% cover after 2 years and 70% cover 5 years."
Method:
1. The area (or areas) chosen to represent the site's progress are delineated by a macroplot (or macroplots) that are sample in the 2nd and 5th years.
2. The sampling method within each macroplot is referred to as systematic sampling with a random start.
    a. The maximum point spacing is computed to fit 200 points (explained below in number 3) in each macroplot.
    b. One side of the macroplot is chosen as the baseline (X), from which transects are run at 90 degrees (Y). The location of the first transect along the baseline is chosen randomly from between 0 and 5 m, while the first sampling location along the Y axis is also selected randomly from between 0 and 4 m.
3. Each observation (or point) is obtained by lowering a vertical cylindrical metal rod with a sharp pin at the tip to note which species are covering the ground at that location.
4. The habitat type of each point is also noted (emergent, vernal pool, *Deschampsia cespitosa* dominated wet prairie, side slope, or old field).
5. The percentage of ground covered by each species is calculated by dividing the total number of observations of each plant by the total number of points. Cover estimates are given with 90% binomial confidence intervals.

Frequency Sampling
Purpose: To assess the progress of each site in meeting the Bank MOA performance standard on species type, which states that, "Of the plant species occurring at a 50% frequency rate or greater, at least 75% shall be from the Native Plant list of the West Eugene Wetlands Plan." These data are also used to assess the site's progress on the diversity and structure goals for wet prairie and emergent habitats. A minimum of 10 native species should occur at 10% frequency rate or greater in wet prairie, while a minimum of 5 native species should occur at a 10% frequency rate or greater in emergent habitats.
Method:
1. Macroplot setup and sampling are similar to the point-intercept methods; however, only 100 observations are required.
2. Each observation consists of noting the presence of each species in a 1 x 1m frame.

3. To obtain the frequency value for each species, the number of times a species is observed within the frame is divided by the total number of frames observed (100). Frequency estimates are also reported with 90% binomial confidence intervals.

Line-intercept Sampling
Purpose: To assess the progress of each site in meeting goals of woody vegetation removal for enhancement areas. For these site-specific goals, refer to the MIP for the enhancement of interest.
Method:
1. The line-intercept method is utilized for estimating the percent cover of shrubs in an enhancement area.
2. Transects are run perpendicular to the macroplot baseline. The segments of the transect that are covered by shrubsare recorded.
3. The percent cover of each shrub species is computed by dividing the length of all transects covered by that species by the combined length of all the transects.

Rare Plant Census
Purpose: To monitor the population changes of the rare and endangered species on Bank enhancement areas. Where applicable, these data will also be used to assess the effects of management actions on the populations of rare species.
Methods for *Erigeron decumbens* var. *decumbens*, *Lomatium bradshawii*, and *Horkelia congesta* ssp. *congesta*:
1. Macroplots were delineated around the entire populations of these rare species where they occur. The macroplot is divided into $1m^2$ plots, and all plots are sampled.
2. The total number of crowns (plants > 3.5 cm apart), flowers, and reproductive crowns are recorded for *Erigeron decumbens* var. *decumbens*. The total number of crowns, flowering stems per crown, and reproductive crowns are recorded for *Horkelia congesta* ssp. *congesta*. For *Lomatium bradshawii*, the total number of plants, leaves and flowering stalks are counted.

Methods for *Aster curtus*:
All populations at Oxbow West and Balboa
1. Each population is marked by a rebar placed approximately in the center of the populations.
2. The total number of ramets? is obtained by dividing the populations into sections and counting all individuals in each section.

Populations that fall within macroplots for other rare species (North Greenhill Ash Grove and Balboa)
1. The macroplot is divided into $1m^2$ plots, and all plots are sampled.
2. The presence or absence of *Aster curtus* is noted in each plot. The frequency of *Aster curtus* is obtained for each macroplot. (The total number of ramets is not obtained.)

Methods *Lupinus sulphureus* ssp. *kincaidii*:
1. Macroplots were delineated around the entire population. The macroplot is divided into $1m^2$ plots, and all plots are sampled.
2. The total number of leaves and inflorescences are tallied for the macroplot by counting them in each plot.

Wildlife Surveys
Purpose: To document wildlife usage in restoration and enhancement sites.
Method: Volunteers and the wetland staff make note of wildlife sightings as they occur.

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie					Oxbow West	Stewart Pond		Turtle Swale	Turtle Swale	Willow Creek
			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Acer macrophyllum	bigleaf maple	N						X															
Achillea millefolium	yarrow	N		X		X				X								X		X			
Agrostis exarata	spike bentgrass	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Agrostis stolonifera/capillaris	fiorin (bentgrass)	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X
Aira caryophyllea	silver hairgrass	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Alisma lanceolatum	narrowleaf waterplantain	I	X			X		X													X		X
Alisma plantago-aquatica	waterplantain	N	X	X	X	X	X	X	X	X	X	X	X		X		X				X	X	X
Allium amplectens	slimleaf onion	N	X	X		X	X	X		X	X	X	X					X			X		
Alnus rubra	red alder	N																					
Alopecurus geniculatus	water foxtail	N	X		X	X	X	X	X			X			X				X	X	X		
Alopecurus pratensis	meadow foxtail	I	X	X	X				X	X	X	X	X	X	X	X		X	X	X			
Amelanchier alnifolia	western serviceberry	N	X	X		X	X			X	X							X					
Anagallis arvensis	scarlet pimpernel	I			X	X		X	X	X	X	X											
Anaphalis margaritacea	pearly-everlasting	N			X						X												
Anthemis cotula	mayweed chamomile	I	X		X	X				X	X	X								X			
Anthoxanthum odoratum	sweet vernalgrass	I	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
Anthriscus caucalis	bur-chervil	I			X																		
Arrhenatherum elatius	tall oatgrass	I																					
Aster hallii	Hall's aster	N	X	X	X	X	X	X	X	X	X	X	X					X				X	X
Avena fatua	wild oat	I	X		X							X							X	X			
Baccharis pilularis	coyote brush	N											X										
Barbarea orthoceras	wintercress	N			X				X														
Beckmannia syzigachne	American sloughgrass	N	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X
Berberis aquifolium	tall Oregon grape	N			X				X														
Bidens cernua	nodding beggars-tick	N					X	X				X							X	X			
Bidens frondosa	leafy beggars-tick	N	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X
Brassica campestris	field mustard	I	X		X	X		X				X	X										
Briza minor	little quaking-grass	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
Brodiaea coronaria	harvest brodiaea	N	X	X						X	X							X					
Bromus carinatus	California brome	N	X																				
Bromus hordeaceus	soft brome	I	X	X	X		X		X	X	X	X	X	X	X			X	X	X			X
Bromus rigidus	ripgut brome	I										X											

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			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Bromus sitchensis	sitka brome	N	X																				
Calandrinia ciliata	red maids	N											X										
Callitriche heterophylla	water starwort	N				X							X										
Callitriche stagnalis	pond water-starwort	I				X																	
Camassia leichtlinii	tall camas	N		X		X				X	X							X		X	X	X	
Camassia quamash	common camas	N	X	X		X	X		X	X	X		X	X	X	X		X		X	X		X
Cardamine oligosperma	little western bittercress	N	X	X		X						X								X			
Cardamine penduliflora	Willamette V. bittercress	N	X	X					X				X					X					
Carex densa	dense sedge	N	X	X	X	X	X	X	X	X	X	X	X						X	X		X	X
Carex echinata	muricate sedge	N																					
Carex feta	green-sheath sedge	N	X	X		X	X		X	X	X	X	X						X				
Carex lanuginosa	wooly sedge	N																					
Carex obnupta	slough sedge	N	X	X		X						X							X	X	X		X
Carex ovalis	hare sedge	I	X	X		X	X	X	X	X	X		X					X	X	X				
Carex species	sedge	N	X		X	X			X	X	X	X	X							X	X		
Carex stipata	sawbeak sedge	N				X	X																
Carex tumulicola	foothill sedge	N	X																				
Carex unilateralis	one-sided sedge	N	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X		X	X
Castilleja tenuis	hairy owl-clover	N	X	X	X			X	X	X	X	X	X	X	X	X	X	X		X	X	X	
Centaurium erythraeae	common centaury	I	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X
Centaurium muhlenbergii	monterey centaury	N	X				X		X	X	X	X	X								X		
Centunculus minimus	chaffweed	N	X			X	X		X	X			X										
Cerastium glomeratum	sticky chickweed	I	X	X	X	X		X	X	X		X	X	X	X				X	X	X		X
Chamomilla suaveolens	pineapple weed	N			X								X										
Cichorium intybus	chicory	I																					
Cirsium arvense	Canada thistle	I	X	X	X	X	X		X	X	X	X	X		X				X	X	X	X	X
Cirsium vulgare	bull thistle	I	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X			X
Convolvulus arvensis	bindweed	I	X		X	X						X											X
Crataegus monogyna	English hawthorn	I	X	X	X	X	X		X	X		X						X	X	X			
Crataegus suksdorfii	black hawthorn	N	X	X		X	X	X	X	X	X	X						X	X		X		X
Crataegus suksdorfii X monogyna	Hybrid hawthorn	I	X	X		X	X	X	X	X		X						X		X			X

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			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Cuscuta sp.	dodder											X											
Cynosurus cristatus	crested dogtail	I										X						X					
Cynosurus echinatus	hedgehog dogtail	I	X		X			X		X	X	X	X							X			
Cyperus acuminatus	short-pointed flatsedge	N	X		X	X	X																
Cyperus eragrostis	tall flatsedge	I					X																
Cyperus squarrosus	awned flatsedge	N				X																	
Cytisus scoparius	broom	I	X	X		X	X	X	X	X	X	X	X					X	X				X
Dactylis glomerata	orchard-grass	I																					
Danthonia californica	California oatgrass	N	X	X	X	X	X	X	X	X	X		X		X			X				X	X
Daucus carota	Queen Anne's lace	I	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X			X
Delphinium menzeisii	Menzies' larkspur	N																					
Deschampsia cespitosa	tufted hairgrass	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Deschampsia danthonioides	annual hairgrass	N	X						X			X			X	X	X				X		
Deschampsia elongata	slender hairgrass	N				X									X								
Dianthus armeria	Deptford pink	**I**	X										X										X
Dipsacus fullonum	teasel	I	X	X	X	X	X	X	X	X	X	X	X						X	X	X		X
Downingia elegans	showy downingia	N	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X		
Downingia yina	Willamette downingia	N	X		X			X	X	X	X	X					X		X	X	X	X	X
Echinochloa crus-galli	large barnyard-grass	I	X		X	X	X	X	X			X	X						X		X		
Eleocharis acicularis	needle spike-rush	N	X	X	X	X	X	X		X	X	X	X						X	X	X		
Eleocharis obtusa	common spike-rush	N	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Eleocharis palustris	common spikerush	N	X	X	X	X	X	X	X			X	X					X	X	X	X	X	X
Eleocharis quadrangulata	squarestem spikerush	N		X																			
Elymus glaucus	blue wildrye	N	X		X					X	X		X										
Epilobium brachycarpum	autumn willowherb	N	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Epilobium ciliatum	hairy willowherb	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Epilobium densiflorum	dense spike-primrose	N	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Epilobium pygmaeum	smooth willowherb	N										X											
Equisetum sp.	horsetail	N	X					X															
Eriophyllum lanatum	wooly sunflower	N	X	X	X	X		X		X	X	X	X		X	X	X	X			X	X	X
Eryngium petiolatum	coyote thistle	N	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X		X
Festuca arundinacea	tall fescue	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X

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			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Fragaria virginiana	strawberry	N		X		X	X					X			X	X		X					
Fraxinus latifolia	Oregon ash	N	X	X	X	X	X	X	X	X	X	X	X					X	X	X			X
Galium aparine	catchweed	I										X						X	X	X			X
Galium parisiense	wall bedstraw	I	X	X			X		X	X	X	X						X	X	X			
Galium trifidum	small bedstraw	N	X	X			X	X				X	X					X	X	X			
Galium triflorum	sweet scented bedstraw	N										X											
Gentiana sceptrum	staff gentian	N			X																		
Geranium dissectum	cut-leaved geranium	I	X	X	X	X				X	X	X		X				X	X	X	X	X	X
Geranium spp.	geranium	I			X				X			X											
Geum macrophyllum	Oregon avens	N				X	X																
Glyceria occidentalis	western mannagrass	N	X	X		X	X	X	X		X	X					X		X	X	X		X
Gnaphalium palustre	lowland cudweed	N	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	
Gnaphalium purpureum	purple cudweed	I	X																				
Gnaphalium uliginosum	marsh cudweed	I																					
Gratiola ebracteata	bractless hedge-hyssop	N	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X
Grindelia integrifolia	Willamette V. gumweed	N	X	X	X	X		X	X	X	X	X	X		X		X	X	X	X	X	X	X
Heracleum lanatum	cow parsnip	N		X		X	X	X		X								X					
Heterocodon rariflorum	heterocodon	N								X													
Holcus lanatus	velvet grass	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hordeum brachyantherum	meadow barley	N	X		X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Hordeum geniculatum	Mediterranean barley	I							X														
Hypericum anagalloides	bog or trailing St. John's-wort	N																					
Hypericum perforatum	St. John's-wort	I	X	X	X	X	X	X	X	X	X	X	X		X		X	X		X	X	X	
Hypochaeris radicata	false dandelion	I	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		X
Isoetes nutalli	Nuttall's quillwort	N										X											
Isoetes sp.	quillwort	N																					
Juncus acuminatus	tapered rush	N	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X
Juncus articulatus	jointed rush	N	X										X										
Juncus bolanderi	Bolander's rush	N	X			X	X	X		X	X	X	X	X					X	X	X	X	X
Juncus bufonius	toad rush	N	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X
Juncus effusus	soft rush	N	X	X		X	X	X		X	X	X	X						X	X	X	X	X

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			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Juncus ensifolius	swordleaf rush	N	X	X	X	X	X	X		X	X		X						X	X	X	X	
Juncus marginatus	grass-leaf rush	I	X	X			X		X	X	X							X					
Juncus nevadensis	Nevada rush	N	X	X		X	X		X	X	X	X											
Juncus oxymeris	pointed rush	N	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X
Juncus patens	spreading rush	N	X	X		X	X	X		X	X	X						X	X	X	X	X	X
Juncus tenuis	slender rush	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Kickxia elatine	cancerwort	I	X		X	X						X								X			
Koeleria cristata	prairie junegrass	N																					
Lactuca saligna	willow lettuce	I	X									X					X		X				
Lactuca serriola	prickly lettuce	I	X	X		X			X			X	X						X	X			X
Lamium purpureum	red dead-nettle	I										X											
Lasthenia glaberrima	smooth lasthenia	N	X		X	X		X	X	X	X	X	X		X		X				X	X	
Lathyrus aphaca	yellow vetch	I			X																		
Lathyrus latifolius	everlasting pea	I	X		X																		
Lathyrus sphaericus	grass pea-vine	I	X		X							X			X	X					X		X
Leersia oryzoides	cutgrass	N				X																	
Leontodon taraxacoides	hairy hawkbit	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lepidium sp.	peppergrass																						
Leucanthemum vulgare	oxeye daisy	I	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X			X
Lindernia anagallidea	false-pimpernel	N																					
Linum bienne	pale flax	I	X	X	X	X	X			X		X						X					X
Lolium multiflorum	Italian ryegrass	I	X		X			X				X							X				
Lolium perenne	perennial ryegrass	I							X	X	X	X							X				X
Lomatium nudicaule	barestem desert-parsley	N	X					X			X				X						X		X
Lonicera hispidula	hairy honeysuckle	N																					
Lotus corniculatus	bird'sfoot trefoil	I		X		X	X		X			X									X		X
Lotus formosissimus	seaside lotus	N	X	X	X	X	X	X	X	X	X		X	X				X	X	X	X	X	X
Lotus micranthus	small-flowered deervetch	N	X	X		X		X	X		X	X	X								X		
Lotus pinnatus	meadow deervetch	N		X						X					X								
Lotus unifoliatus	Spanish-clover	N	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Ludwigia palustris	water purslane	N	X	X	X	X	X	X				X	X						X		X	X	
Lupinus bicolor	field lupine	N	X	X	X	X		X		X	X	X								X	X		

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			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Lupinus polyphyllus	bigleaf lupine	N							X		X	X	X				X					X	
Lupinus rivularis	stream lupine	N	X	X	X		X	X	X		X	X					X					X	
Luzula comosa	field woodrush	N	X	X		X		X		X	X		X		X	X		X					
Lysimachia nummularia	moneywort	I				X	X		X														
Lythrum hyssopifolia	hyssop loosestrife	I	X		X	X													X				
Lythrum portula	water-purslane	I	X	X	X	X	X		X	X		X							X	X	X	X	
Lythrum salicaria	purple loosestrife	I			X																		
Madia elegans	showy tarweed	N	X		X	X		X	X	X	X	X			X					X			
Madia glomerata	cluster tarweed	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Madia sativa	coast tarweed	N	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X
Malus fusca	western crab-apple	N	X	X		X					X	X						X					
Melilotus alba	white sweetclover	I				X																	
Mentha pulegium	pennyroyal	I	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X
Mentha spicata	spearmint	I			X																		
Microseris laciniata	cut-leaved microseris	N	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Mimulus guttatus var. depauperatus	depauperate monkeyflower	N			X																		
Moenchia erecta	moenchia	I	X	X	X				X	X	X	X	X	X	X		X						X
Montia fontana	water chickweed	N	X		X						X												
Montia linearis	narrow-leaved montia	N	X	X	X			X	X	X	X	X	X	X	X						X		X
Myosotis discolor	yellow & blue forget me not	I	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X		X
Myosotis laxa	small-flowered forget me not	N	X	X	X	X		X				X	X				X		X	X	X	X	
Myosotis verna		N			X																		
Myosurus minimus	least mouse-tail	N																			X		
Navarretia intertexta	needle-leaved navarrertia	N	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X		X	X	X
Navarretia squarrosa	skunkweed	N	X			X		X			X	X									X		
Nemophila menziesii	baby blue eyes	N		X																			
Nemophila parviflora	small flower nemophila	N			X																		
Oenanthe sarmentosa	Pacific water-parsley	N			X																		
Orthocarpus bracteosus	rosy owl-clover	N	X	X	X	X		X	X	X	X	X	X	X	X	X	X				X	X	

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Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie					Oxbow West	Stewart Pond		Turtle Swale	Turtle Swale	Willow Creek
			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Panicum acuminatum ssp. *fascicularis*	western witchgrass	N	X	X	X	X	X	X	X	X	X		X		X			X			X	X	X
Panicum capillare	common witchgrass	N	X	X		X		X					X								X		
Parentucellia viscosa	yellow parentucellia	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X
Perideridia gairdneri	yampah or false-carraway	N		X																			
Perideridia oregana	Oregon yampah	N		X							X		X										
Phalaris aquatica	Harding grass	I	X	X			X	X	X	X		X							X	X	X		X
Phalaris arundinacea	reed canarygrass	I	X	X	X	X	X	X	X	X		X						X	X	X			X
Phleum pratense	timothy	I			X							X	X							X			
Pholx gracilis	pink microsteris	N	X		X			X	X	X	X	X	X	X	X	X	X	X			X		
Physocarpus capitatus	Pacific ninebark	N																					
Plagiobothrys figuratus	fragrant popcorn-flower	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Plagiobothrys scouleri	Scouler's popcorn-flower	N	X	X	X	X		X			X		X							X			
Plantago lanceolata	English plantain	I	X	X	X	X	X	X	X	X	X	X	X					X	X				X
Plantago major	common plantain	I										X											
Plectritis congesta	rosy plectritis	N										X											
Poa annua	annual bluegrass	I	X		X	X					X		X	X									
Poa compressa	Canada bluegrass	I	X		X	X							X										
Poa triviale	Kentucky bluegrass	I	X		X	X		X		X		X								X			
Polygonum aviculare	doorweed	I	X					X															
Polygonum douglasii	douglas knotweed	N	X	X		X	X																
Polygonum hydropiperoides	marshpepper smartweed	N	X	X	X		X					X							X	X	X		
Polygonum persicaria	heartweed	I	X		X	X	X	X	X			X							X		X		
Polypogon monspeliensis	rabbitfoot polypogon	I				X	X					X									X		
Polystichum munitum	western swordfern	N			X	X																	
Populus trichocarpa	black cottonwood	N	X	X	X	X	X	X	X	X	X	X	X						X	X			X
Potentilla gracilis	slender cinquefoil	N	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		X
Prunella vulgaris	self-heal	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Prunus sp.	"Thundercloud" plum	I								X													
Pseudotsuga menziesii	Douglas-fir	N			X	X			X														X
Psilocarphus spp.	wooly heads	N			X							X	X				X				X		
Pyrus communis	pear	I	X	X			X			X		X											

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			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Pyrus malus	apple	I			X																		
Quercus garryana	Oregon white oak	N							X	X													
Quercus kelloggii	California black oak	N			X	X	X	X	X														
Ranunculus alismaefolius	water-plantain buttercup	N			X								X									X	X
Ranunculus aquatilis	white water buttercup	N		X															X	X			
Ranunculus flammula	creeping buttercup	N																					
Ranunculus occidentalis	western buttercup	N	X	X	X	X		X			X	X			X	X	X		X		X		
Ranunculus orthorhynchus	straight beaked buttercup	N	X	X	X	X		X	X		X	X	X	X	X	X	X		X		X	X	X
Ranunculus repens	creeping buttercup	I			X						X	X	X										
Ranunculus sceleratus	celery-leaf butter-cup	N?			X			X															
Ranunculus uncinatus	little buttercup	N													X								
Rhamnus purshiana	cascara	N		X	X	X	X																
Rorippa curvisiliqua	western yellowcress	N	X			X	X	X	X	X	X	X	X		X		X		X	X	X	C	
Rorippa nasturtium-aquaticum	watercress	N											X										
Rosa eglanteria	sweetbriar	I	X	X		X	X			X													
Rosa multiflora	many flowered rose	I	X	X	X	X	X		X	X	X	X	X						X	X			X
Rosa nutkana	Nootka rose	N	X	X	X	X	X	X	X	X	X	X	X		X			X		X	X		X
Rosa pisocarpa	peafruit rose	I																	X				
Rubus armeniacus	Himalayan blackberry	I	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X
Rubus laciniatus	evergreen blackberry	I	X	X	X	X	X			X		X						X			X		
Rubus ursinus	Pacific blackberry	N		X				X															
Rumex acetocella	sheep sorrel	I	X	X	X	X	X	X	X	X	X	X	X		X		X	X			X	X	
Rumex conglomeratus	clustered dock	I	X																				
Rumex crispus	curly dock	I	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X		X
Rumex salicifolius	willow dock	N	X	X	X	X	X	X	X		X	X	X					X		X	X	X	X
Salix geyeriana	Geyer willow	N			X																		
Salix hookeriana	Hooker willow	N																					
Salix lasiandra	Pacific willow	N										X											
Salix piperi	Piper's willow	N					X					X											
Salix scouleriana	Scouler willow	N			X	X		X															
Salix sessilifolia	Northwest willow	N			X																		

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Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie					Oxbow West	Stewart Pond		Turtle Swale	Turtle Swale	Willow Creek
			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Salix sitchensis	Sitka willow	N				X					X	X											
Salix sp.	willow		X		X	X	X			X		X							X	X			X
Sanicula sp.	sanicle		X		X			X	X														
Sanquisorba occidentalis	annual burnet	N				X																	
Saxifraga integrifolia	swamp saxifrage	N		X	X				X	X			X	X									
Saxifraga oregana	bog saxifrage	N	X	X					X	X								X					
Scirpus americanus	bulrush	N			X		X																
Scirpus microcarpus	small-fruited bulrush	N			X																		
Scirpus tabernaemontani	softstem bulrush	N					X			X											X		X
Senecio jacobea	tansy ragwort	I	X	X	X	X	X		X	X	X	X	X		X	X		X		X		X	X
Senecio sylvaticus	wood groundsel	I			X							X							X				
Senecio vulgaris	old-man-in-the-spring	I	X			X							X										
Sherardia arvensis	blue field-madder	I										X											
Sidalcea campestris	meadow sidalcea	N	X			X							X										
Sidalcea cusickii	Cusick's checker-mallow	N	X							X	X		X	X				X			X		
Sidalcea virgata	rose checker-mallow	N											X										
Sisyrinchium californicum	golden-eyed grass	I				X																	
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass	N		X	X			X	X						X								
Sisyrinchium idahoense	Idaho blue-eyed grass	N	X	X	X	X			X	X	X		X					X		X	X	X	X
Sitanion hystrix	squirrel-tail bottlebursh	N										X		X									
Solanum dulcamara	climbing nightshade	I	X			X													X				
Solidago canadensis	Canada goldenrod	N		X																			
Sonchus asper	prickly sow-thistle	I	X	X	X	X	X		X	X	X	X	X					X	X	X	X		X
Sorghum halapense	Johnson grass	I						X															
Sparganium emersum	simplestem bur-reed	N																					
Spergula arvensis	stickwort	I		X						X	X												
Spergularia rubra	red sandspurry	I	X								X												
Spiraea douglasii	Douglas spirea	N	X	X		X	X			X	X												X
Spiranthes romanzoffiana	ladies-tresses	N						X		X										X			
Stellaria media	chickweed	I				X																	
Taraxicum officinale	dandelion	I	X				X		X	X	X	X											
Toxicodendron diversiloba	poison oak	N		X		X	X			X	X							X					

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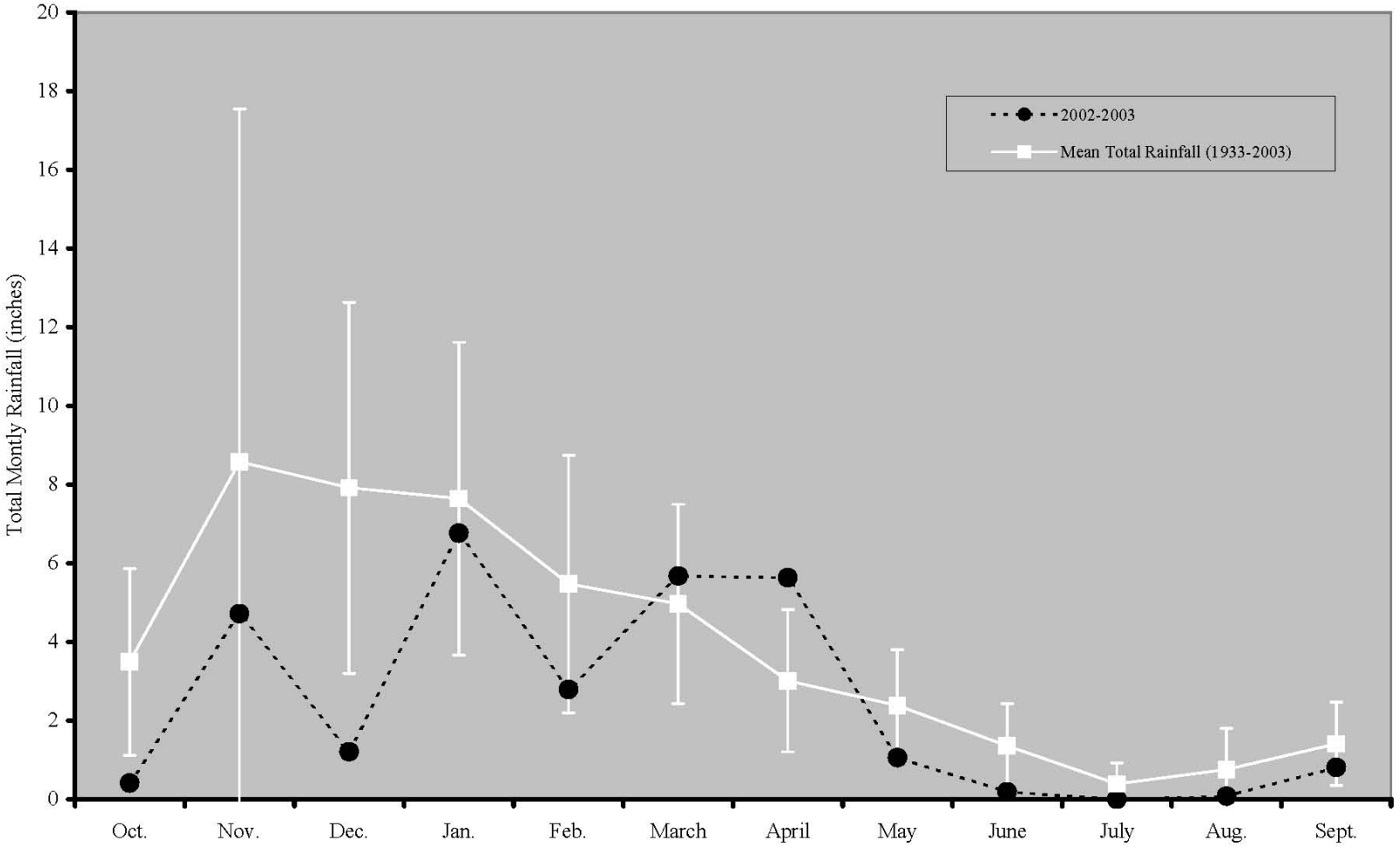
			R1&2	E	A/P	R1	E	R2	R	E	R	R	E1	Sol 1(E)	E2	Sol 2(E)	E3	E	Pond	R	R1	R2	R
Trichostema lanceolatum	vinegar weed	N																					
Trifolium dubium	least hop clover	I	X	X	X	X			X	X	X	X		X	X	X	X			X	X		X
Trifolium hybridum	hybrid clover	I	X			X	X	X	X			X											
Trifolium pratense	red clover	I	X	X				X				X								X			
Trifolium repens	white clover	I	X	X					X			X								X	X		X
Trifolium subterraneum	subterranean clover	I	X					X	X														
Trifolium variegatum	white-tip clover	N																					
Triphysaria versicolor ssp. versicolor	johnnytuck	N		X									X										
Triteleia hyacinthina	hyacinth brodiaea	N		X					X	X	X	X						X			X		
Typha latifolia	cat-tail	N	X	X	X	X	X					X											X
Verbascum blattaria	moth mullein	I				X						X											
Verbascum thapsus	common mullein	I										X											
Veronica americana	American speedwell	N	X	X		X						X							X	X	X		X
Veronica arvensis	wall speedwell	I			X								X										
Veronica peregrina	purslane speedwell	N	X		X	X			X		X	X	X				X	X		X	X	X	
Veronica scutellata	marsh speedwell	N	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
Viburnum ellipticum	Oregon viburnum	N						X															
Vicia cracca	bird vetch	I	X	X	X		X		X		X	X			X	X							X
Vicia hirsuta	hairy vetch	I	X	X		X		X				X								X			
Vicia sativa	common vetch	I	X	X	X	X		X	X	X	X	X	X			X		X		X			
Vicia tetrasperma	slender vetch	I	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X		X
Vulpia bromoides	barren fescue	I	X		X	X		X		X	X	X	X		X		X	X				X	X
Vulpia myuros	rat-tail fescue	I										X											
Vulpia sp. (annual)	annual fescue	I											X										
Wyethia angustifolia	narrow-leaf mule's ears	N	X	X					X	X	X	X	X		X		X	X					
Zigadenus venenosus	death camas	N		X					X	X													



Appendix C. Monthly rainfall totals for Eugene Airport during 2002-2003 compared to the mean and standard deviation of monthly rainfall between 1940 and 2003.